

Data Package for Groundwater Monitoring Well 299-W19-46 at the 200-UP-1 Operable Unit

D. G. Horton

April 2003



Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RL01830

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or Battelle Memorial Institute.

PACIFIC NORTHWEST NATIONAL LABORATORY

operated by

BATTELLE

for the

UNITED STATES DEPARTMENT OF ENERGY

under Contract DE-AC06-76RL01830

Printed in the United States of America

**Available to DOE and DOE contractors from the
Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831;
prices available from (615) 576-8401.**

**Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161**



This document was printed on recycled paper.

**Data Package for Groundwater
Monitoring Well 299-W19-46 at the
200-UP-1 Operable Unit**

D. G. Horton

April 2003

Prepared for
the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest National Laboratory
Richland, Washington 99352

Contents

1.0	Introduction	1
2.0	Well 299-W19-46.....	1
2.1	Drilling and Sampling	1
2.2	Well Completion	3
2.3	Well Development and Pump Installation.....	4
2.4	Groundwater Sampling and Analysis.....	4
3.0	References	5
	Appendix A – Well Construction and Completion Documentation	A.1
	Appendix B – Physical Properties Data	B.1
	Appendix C – Groundwater Composition Data.....	C.1
	Appendix D – Borehole Geophysical Logs	D.1

Figure

1	Location Map for New Well 299-W19-46.....	2
---	-------------------------------------------	---

Table

1	Survey Data for New Well 299-W19-46	4
---	-------------------------------------------	---

1.0 Introduction

One new groundwater monitoring well was constructed in the 200-UP-1 Operable Unit in November 2002. The purpose of the well is to monitor the concentration of technetium-99 and uranium in groundwater associated with the pump-and-treat systems in the 200-UP-1 Operable Unit. The well name is 299-W19-46 and the corresponding well number is C3958. Well 299-W19-46 is located off the southwest corner of the 216-U-17 crib and east of Beloit Avenue. It is a replacement well for well 299-W19-38, which has gone dry. The location of the well is shown on Figure 1.

Well 299-W19-46 was drilled in response to the recommendations of a data quality objectives process that indicated a need for additional monitoring wells in the area (BHI-01576). The new well was constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160 and WAC 173-303, the Data Quality Objectives document (BHI-01576), and the description of work for well drilling and construction (Fruchter 2002).^(a)

This document compiles information on the drilling and construction, geophysical logging, and sediment and groundwater sampling applicable to the installation of well 299-W19-46. The information on drilling and construction, well development, and pump installation is summarized from CP-14265. Appendix A contains the Well Summary Sheets (as-built diagrams), the Well Construction Summary Reports, and the geologist's logs; Appendix B contains results of physical properties testing; Appendix C contains the analytical results from groundwater samples obtained during drilling; and Appendix D contains borehole geophysical logs. Additional documentation concerning well construction can be found in CP-14265 and is on file with Fluor Hanford, Inc., Richland, WA.

Except for survey coordinates, English units are used in this report because that is the system of units used by drillers to measure and report depths and well construction details. To convert feet to meters, multiply by 0.3048; to convert inches to centimeters multiply by 2.54.

2.0 Well 299-W19-46

2.1 Drilling and Sampling

Well 299-W19-46 was drilled in November 2002 with a Becker hammer drill rig from the surface to a total depth of 379 feet below the surface (bgs) with temporary dual-wall carbon steel casing. No water was added to the borehole during drilling.

(a) Letter from J. S. Fruchter (Pacific Northwest National Laboratory, Richland, Washington) to R. L. Jackson (Fluor Hanford, Inc., Richland, Washington), *Description of Work for Drilling of CY 2001 RCRA and CERCLA Groundwater Monitoring Wells*, dated July 11, 2002.

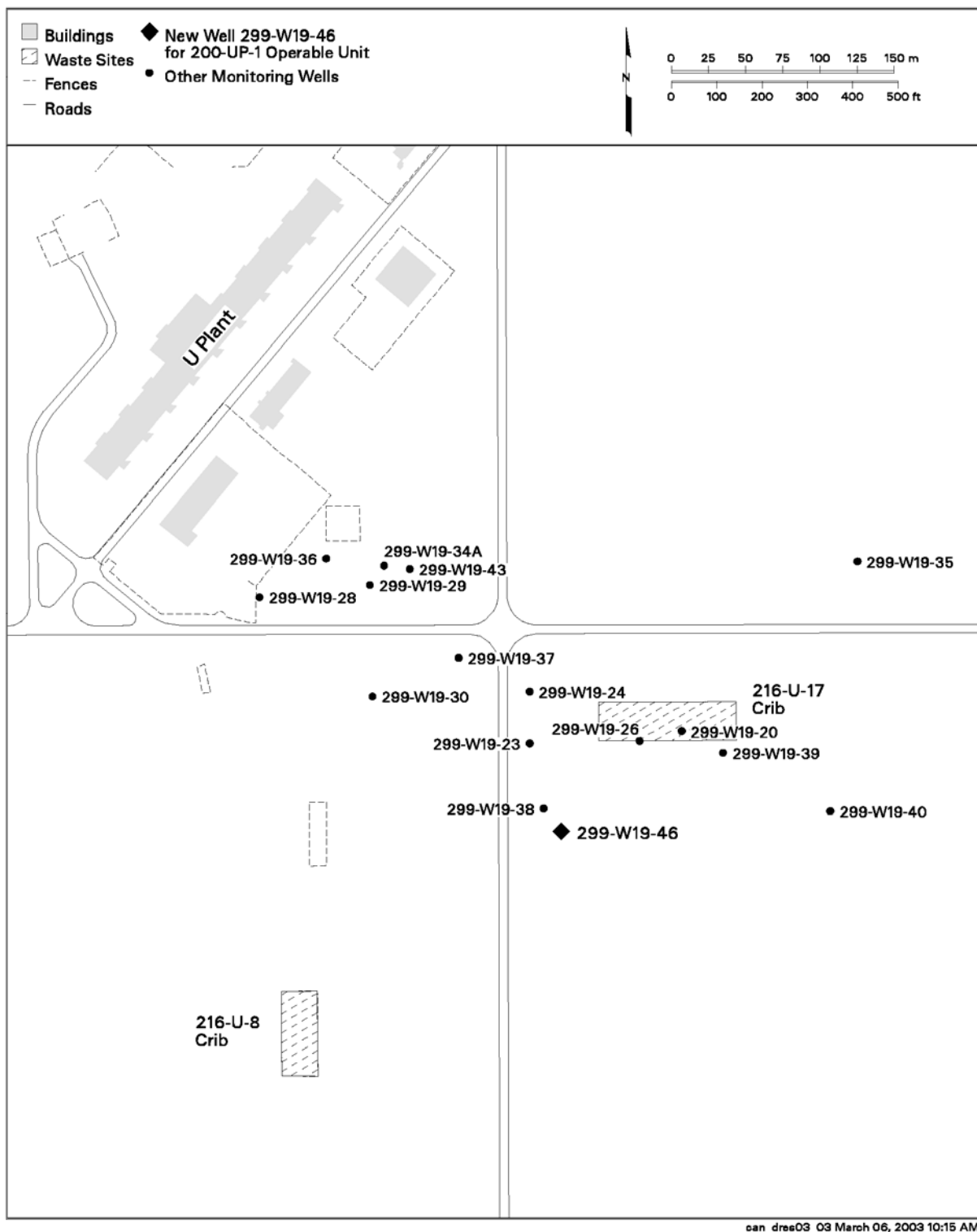


Figure 1. Location Map for New Well 299-W19-46

The sediments encountered during drilling were predominantly Hanford formation sand, silty sand, and gravelly sand from the surface to 170 feet bgs; upper Cold Creek unit silty sand (formerly Plio-Pleistocene silt unit) from 170 to 185 feet bgs; lower Cold Creek unit sand and silty sand with massive caliche (formerly Plio-Pleistocene caliche unit) from 185 to 210 feet bgs; upper Ringold Formation silt, sand, silty sand, and gravelly sand from 210 to 253 feet bgs; and Ringold Formation unit E sandy gravel and silty sandy gravel from 253 feet to total depth (379 feet bgs). The geologist's log is included in Appendix A.

Grab samples for geologic description and archive were collected every 5 feet throughout the borehole. Also, two grab samples were collected from 260 and 295 feet bgs for analysis of particle size distribution. Particle size distribution data are in Appendix B.

Seven groundwater samples to characterize the vertical distribution of contaminants were collected during drilling of well 299-W19-46. The upper most sample was air lifted because the aquifer would not supply enough water at that depth to pump a sample to the surface. The remaining samples were pumped after purging for 40 to 60 minutes. The sampling and analysis efforts are discussed below in Section 2.4. All analytical results are given in Appendix C.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. Organic vapors were detected in the borehole and/or on sediment samples at various depths during drilling at concentrations less than about 5 parts per million (ppm). No organic vapors were detected in the breathing zone around the well during drilling and construction activities.

The borehole was geophysically logged with a spectral gamma-ray tool on November 21 and 25, 2002. No manmade radionuclides were detected. Geophysical logs are included in Appendix D.

2.2 Well Completion

Well 299-W19-46 was backfilled with 4 to 8 mesh silica sand from 378.3 to 300.0 feet bgs and with 0.25-inch bentonite pellets from 300 to 295.2 feet bgs.

The permanent casing and screen were installed in well 299-W19-46 in November and December 2002. A 4-inch-inner-diameter, stainless steel, wire wrap, 20 slot screen was set from 255 to 290 feet bgs. The permanent casing is 4-inch-inner-diameter, stainless steel from 255 feet bgs to 2.0 feet above ground surface. A 2-foot-long stainless steel sump is below the screen from 290 to 292 foot depth.

The filter pack is 10 to 20 mesh silica sand from 295.2 to 245.2 feet bgs. The filter pack was settled by surge block. The annular seal is bentonite pellets from 245.2 to 239 feet bgs, granular bentonite from 239 to 9.8 feet bgs, and Portland cement from 9.8 feet bgs to the surface. A 4-foot-by-4 foot, 6-inch concrete pad was placed around the well at the surface. A protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The protective casing extends 2.34 feet above the concrete pad. The Well Summary Sheet (as-built), Well Attributes Report, and Well Construction Summary Report are included in Appendix A.

Table 1. Survey Data for New Well 299-W19-46

Well Name	Easting (m) ^(a)	Northing (m) ^(a)	Elevation (m) ^(b)	
299-W19-46	567782.67	134842.46	214.101	Top of Casing
	567782.748	134842.740	213.388	Brass Cap
(a) Washington coordinate system of 1983, south zone 1991				
(b) North American vertical datum of 1988.				

A 4.5-foot-long section of the stainless steel tape used to tag well construction material was broken and incorporated in the sand pack at about 245 feet bgs.

The vertical and horizontal coordinates of the well were surveyed in February 2003. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington and the U. S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing benchmarks established by the U. S. Army Corps of Engineers. Note that survey coordinates are measured and reported in metric.

2.3 Well Development and Pump Installation

Well 299-W19-46 was developed in December 2002. A temporary, 5 horsepower, submersible pump was used to remove 2,268 gallons of formation water at 28 gallons per minute (gpm) with the pump intake at 284 feet bgs. Maximum drawdown was 0.5 feet. The pump intake was raised to 272 feet bgs and well development continued by pumping 190 gallons of formation water at 10 gpm. Drawdown was 0.09 foot. The final turbidity was 2.58 NTU.

A dedicated, Redi-Flo3 submersible sampling pump was installed in well 299-W19-46 on December 6, 2002. The sampling pump intake is at 274.3 feet bgs or about 18.6 feet below the water table.

Static water level was 255.72 feet bgs on December 6, 2002.

2.4 Groundwater Sampling and Analysis

Seven groundwater samples were collected during drilling at about 20-foot intervals beginning at 269 feet bgs and continuing to total depth. The water level at the time the first sample was taken was 256.13 feet bgs. The uppermost sample was collect from about 15 feet below the water table because the aquifer did not produce sufficient water to sample above this depth during drilling. Samples from 269, 280, 320 and 360 feet bgs were air lifted; samples from 300, 340, and 379 feet bgs were pumped after purging for 40 to 60 minutes. All samples were sent to the Hanford Groundwater Monitoring Project's contracted laboratories for analyses. All samples for metals analyses were filtered in the field. The air-lifted samples were allowed to settle overnight, and the groundwater was decanted into sample jars before

sending to the laboratories for analyses. Samples were analyzed for anions, iodine-129, metals, technetium-99, tritium, uranium, and volatile organic compounds. All laboratory results are given in Appendix C.

The analytical data show that nitrate, technetium-99 and most metals have maximum concentrations at about 65 feet below the water table (320 feet bgs). The maximum carbon tetrachloride concentration occurs at about 85 feet below the water table and the maximum uranium concentration occurs between 25 and 45 feet below the water table, corresponding to the bottom of the screened interval. Other interpretive reports will investigate these analytical results with respect to the distribution and movement of contamination.

3.0 References

BHI-01576, Rev. 2. 2002. *DQO Summary Report for Establishing a 200-ZP-1 and 200-UP-1 Groundwater Monitoring Well Network*. Bechtel Hanford, Inc., Richland, Washington.

CP-14265, 2003. *Calendar Year 2002 RCRA and CERCLA Groundwater Monitoring Well Summary Report*. C. R. Martinez, Fluor Hanford, Inc., Richland. Washington.

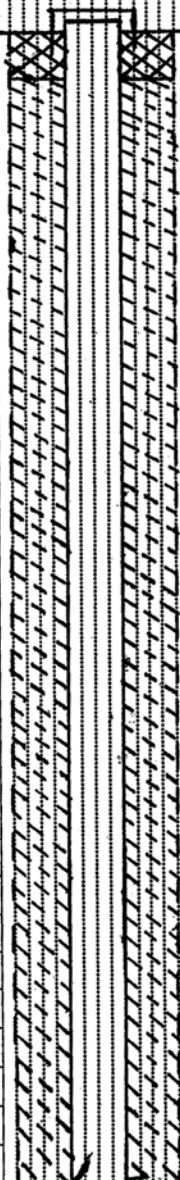
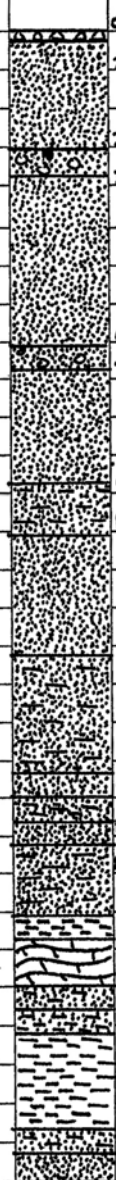
WAC 173-160, Washington Administrative Code. *Minimum Standards for Construction and Maintenance of Wells*. Olympia, Washington.

WAC 173-303, Washington Administrative Code. *Dangerous Waste Regulations*. Olympia, Washington.

Appendix A

Well Construction and Completion Documentation

WELL CONSTRUCTION SUMMARY REPORT				Start Date: <u>11/19/02</u>			
				Finish Date: <u>12/03/02</u>			
				Page <u>1</u> of <u>1</u>			
Well ID: <u>C3958</u>		Well Name: <u>299-W19-46</u>		Approximate Location: <u>S.E. of U-Plant</u>			
Project: <u>Recon Drilling (CERCLA Well)</u>		Other Companies: <u>FH, CHG</u>					
Drilling Company: <u>Layne Christensen</u>		Geologist(s): <u>C. Martinez</u>					
Driller: <u>Paul Lodder ("Darry")</u>		License #: <u>1428</u>					
TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD		HOLE DIAMETER (in) / INTERVAL (ft)		
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter _____ From _____ to _____			
<u>Dual wall CS, FS</u>	<u>0' - 378'</u>	<u>9" O.D.</u>	Cable Tool:	Diameter _____ From _____ to _____			
<u>9" O.D.; 9" I.D.</u>	_____	_____	Air Rotary:	Diameter _____ From _____ to _____			
_____	_____	_____	A.R. w/Sonic:	Diameter _____ From _____ to _____			
_____	_____	_____	<u>Becker Hammer</u>	Diameter <u>9"</u> From <u>0</u> to <u>378'</u>			
_____	_____	_____	<u>W/crowd-in</u>	Diameter _____ From _____ to _____			
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design			<u>drill bit</u>	Diameter _____ From _____ to _____			
Total Drilled Depth: <u>378'</u>			Hole Dia @ TD: <u>9"</u>				
Well Straightness Test Results: <u>Passed using a 20' long.</u>			Total Amt. Of Water Added During Drilling: <u>+105 gals during completion</u>				
4.5" O.D. tool on 11/25/02			Static Water Level: <u>255.42' bgs</u> Date: <u>12/02/02</u>				
GEOPHYSICAL LOGGING							
Sondes (type)	Interval	Date	Sondes (type)	Interval	Date		
<u>Spectral Gamma</u>	<u>0' - 199'</u>	<u>11/21/02</u>					
<u>Spectral Gamma</u>	<u>160' - 380'</u>	<u>11/25/02</u>					
COMPLETED WELL							
Size/Wt./Material	Depth	Thread	Slot Size	Type (C94*)	Interval Angular Seal/Filler Pack	Volume 3	Mesh Size 11A
<u>4" ID 25304L casing</u>	<u>12.00' - 255'</u>	<u>F480</u>	<u>11A</u>	<u>Portland Cement</u>	<u>9.8' - 239'</u>	<u>10795</u>	<u>11A</u>
<u>4" ID 25304L screen</u>	<u>255' - 290'</u>	<u>F480</u>	<u>0.020"</u>	<u>Granular Bentonite</u>	<u>239' - 245.2'</u>	<u>3 buck</u>	<u>1/4"</u>
<u>4" ID 25304L pump</u>	<u>290' - 292'</u>	<u>F480</u>	<u>11A</u>	<u>Bentonite Pellets</u>	<u>245.2' - 295.2'</u>	<u>42.5</u>	<u>10-20</u>
				<u>Colorado Silica Sand</u>	<u>295.2' - 300'</u>	<u>3 buck</u>	<u>1/4"</u>
				<u>Bentonite Pellets</u>	<u>300' - 378.3'</u>	<u>82.5</u>	<u>4-8</u>
				<u>Colorado Silica Sand</u>			
OTHER ACTIVITIES							
Aquifer Test: <u>well development</u>		Date: <u>12/03/02</u>		Well Decommission: Yes: <input type="checkbox"/> No: <input type="checkbox"/> Date: _____			
Description: <u>pumped 28 gpm for 81 min w/ drawdown of 23.972'. Raised pump 20'. Pumped @ 10 gpm for 9 mins w/ X.D. = 6.586'.</u>				Description: _____			
WELL SURVEY DATA (if applicable)							
Washington State Plane Coordinates: _____				Protective Casing Elevation: _____			
Brass Survey Marker Elevation: _____							
COMMENTS/REMARKS							
<u>Vol. calc: P.C. = 3 * 1.285 = 3.86 ft³; gran. bent => 101 * 0.71 = 71.71 ft³; bent. pellets => 6 * 0.42 = 3.72 ft³; 10-20 silica sand => 42.5 * 0.535 = 22.74 ft³; 4-8 silica sand => 82 * 0.467 = 54.28 ft³</u>							
Reported By: <u>Charlene Martinez</u> Title: <u>Geologist/Scientist</u> Signature: <u>Charlene Martinez</u> Date: <u>12/09/02</u>							
Original to: Document & Information Services, H0-09/HWIS							
Distribution by DIS: Environmental Technologies Well Coordinator, H0-02							

WELL SUMMARY SHEET		Start Date: 11/19/02		Page: 1 of 2
Finish Date: 12/02/02				
Well ID: C3958		Well Name: 299-W19-46		
Location: S.E. of U-Plant		Project: RCRA Drilling (CERCLA well)		
Prepared By: Charlene Martinez	Date: 12/04/02	Reviewed By: L.D. Walker	Date: 12/12/02	
Signature: <i>Charlene Martinez</i>		Signature: <i>L.D. Walker</i>		
CONSTRUCTION DATA		GEOLOGIC/HYDROLOGIC DATA		
Description	Diagram	Depth In Feet	Graphic Log	Lithologic Description
Protective casing (6" = 10') set 1.15' above permanent casing.		0		0'-2' Backfill
				2'-25' SAND(S)
4" ID sched 5 SS304L casing: 12.00' → 255'		40		25'-30' gravelly SAND(gS)
				30'-65' SAND(S)
Portland Cement Grout: 0' → 9.8'				65'-70' gravelly SAND(gS)
				70'-95' SAND(S)
Granular Bentonite: 9.8' → 239'		80		95'-105' silty SAND(mS)
				105'-130' SAND(S)
1/4" Bentonite Pellets: 239' → 245.2'		120		130'-155' silty SAND(mS)
10-20 mesh silica sand: 245.2' → 295.2'				155'-160' SAND(S)
4" ID sched 5 0.020-in slot cont. wire-wrap SS304L well screen: 255' → 290'		160		160'-165' silty SAND(mS)
				165'-170' SAND(S)
				170'-185' silty SAND(mS)
				185'-190' SILT(m)
All depths in feet below ground surface.		200		190'-200' CALICHE
		200'-205' silty SAND(mS)		
		205'-210' sandy SILT(sm)		
		210'-230' SILT(m)		
		230'-235' silty SAND(mS)		
All temporary casing removed from ground.		235'-245' SAND(S)		

Original to: Document & Information Services, H0-09/HWIS
 Distribution by DIS: Environmental Technologies Well Coordinator, H0-02
 BHI-EE-189 (02-20-2002)

Start Date:	11/19/02
Finish Date:	12/03/02

Finish Date:	12/02/02
--------------	----------

Well Name: 299-W19-46

Project: RCRA Drilling (CERCLA well)

Reviewed By: L. D. Walker

Date: 12/12/02

Signature: JD Walker

GEOLOGIC/HYDROLOGIC DATA

Description	Diagram	Depth in Feet	Graphic Log	Lithologic Description
4" ID Sched 5 SS 304L Sump: 290' → 292'		240		245'-253' gravelly SAND (GS) 253'-257' SAND (S) 257'-305' sandy GRAVEL (SG)
1/4" Bentonite Pellets: 295.2' → 300'				
4-8 mesh silica sand 300' → 378.3'		280		
muddy backfill: 378.3' → 379'		320		305'-335' silty sandy GRAVEL (MSG)
				335'-340' silty SAND (MS)
				340'-350' sandy GRAVEL (SG)
				350'-355' SAND (S)
		360		355'-376' sandy GRAVEL (SG)
				376'-379' silty sandy GRAVEL (MSG)
			400	
All depths in feet below ground surface.				
All temporary casing removed from ground.				

Distribution by DIS: Environmental Technologies Well Coordinator, H0-02

A.3

BOREHOLE LOG

Page: 1 of 13

Date: 11/19/02

Well ID: C3958 Well Name: 299-W19-46 Location: SE. of U-Plant
Project: RCRA Drilling (CERCLA well) Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample		Graphic Log	Sample Description Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
	Type & No.	Blows & Recovery			
0	Becker Hammer	N/A	▲▲▲▲	0' - 2' Backfill material. Sandy Gravel.	Becker Hammer 9dB
			▲▲▲▲	Basaltic. No rxn HCl	
			▲▲▲▲		
			▲▲▲▲		
5	Grab Becker Hammer			25' - 30' SAND (S) 95% sand, 5% silt. SR-R, v. well sorted, vfn-med. Basaltic (45%)	Grab 5' archive
				@ 10' => sand, vfn-v. coarse, poorly sorted basaltic, SR-SA. 10YR 4/2, dark grayish brown (moist). No rxn HCl.	
10	Grab Becker Hammer			25' - 30' gravelly SAND (gS). 15% gravel. 85% sand, Gravel, SR-A, med-sorted, pred. lg. pebbles-sm cobbles, basaltic.	Grab 10' archive
				Sand. Vfn-v. coarse, poorly sorted, SR-SA. 45-50% basalt. No rxn HCl. 5YR 5/1 gray (moist)	Grab 15' archive
15	Grab Becker Hammer			30' - 45' SAND (S) 95% sand, 5% silt. Sand, SR-SA, med sorted, vfn-v. coarse. 45% basalt. 10YR 4/3 brown (moist)	
				No rxn HCl.	Grab 20' archive
20	Grab Becker Hammer			@ 35' sand, v. well sorted, vfn-med, SR-R. Basalt content down to 25-30%. 10YR 4/4, dark yellowish brown (moist)	
				No rxn HCl.	
25	Grab Becker Hammer			@ 40' sand, vfn-v. coarse, poorly sorted, SR-SA + trace pea-sized gravel. Basaltic. 50% gtz (other). No rxn HCl. 10YR 4/2 dark grayish brown.	Grab 25' archive Top of Hanford @ 25' bgs

Reported By: Charlene Martinez Reviewed By: L.D. Walker
Title: Geologist / Scientist Title: Geologist
Signature: Charlene Martinez Date: 11/19/02 Signature: L.D. Walker Date: 12/11/02

Original to: Document and Information Services, H0-09/HWIS

BOREHOLE LOG					Page: <u>2</u> of <u>13</u>	
					Date: <u>11/19/02</u>	
Well ID: <u>C3958</u>		Well Name: <u>299-1019-46</u>		Location: <u>S. E. of U-Plant</u>		
Project: <u>RCEA Drilling (CERCLA Well)</u>				Reference Measuring Point: <u>Ground surface</u>		
Depth (Ft)	Sample Type & No.	Blows & Recovery	Graphic Log	Sample Description Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
30	Becker Hammer Grab Becker Hammer	N/A		@ 45' same as 40' description. (SAND)	Becker Hammer 9" old Grab 30' sample	
36	Grab Becker Hammer				Grab 35' archive	
40	Grab Becker Hammer				Grab 40' archive	
45	Grab Becker Hammer				@ 50' sand, vfn-vcs, poorly sorted. 50-55' basalt SR-SA. 10YR4/2, dark grayish brown (moist) no rxn HCL.	Grab 45' archive
50	Grab Becker Hammer					Grab 50' archive
55	Grab Becker Hammer				@ 55' sand, trace of pea-sized gravel. similar to above description.	Grab 55' archive

Reported By: <u>Charlene Martinez</u>		Reviewed By: <u>L.D. Walker</u>	
Title: <u>Geologist/Scientist</u>		Title: <u>Geologist</u>	
Signature: <u>Charlene Martinez</u>	Date: <u>11/19/02</u>	Signature: <u>L.D. Walker</u>	Date: <u>12/11/02</u>

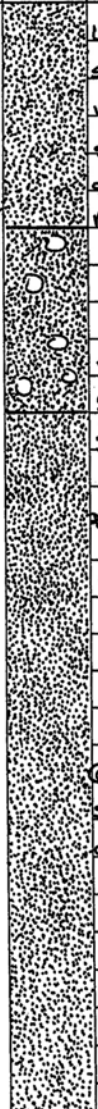
Original to: Document and Information Services, H0-09/HWIS

BOREHOLE LOG

Page: 3 of 13

Date: 11/19/02

Well ID: C3958 Well Name: 299-w19-46 Location: S.E. of U-Plant
Project: RORA Drilling (CERCLA well) Reference Measuring Point: Ground Surface

Depth (Ft)	Sample		Graphic Log	Sample Description	Comments
	Type & No.	Blows & Recovery		Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
60	Becker Hammer Grab	N/A		65'-70' Gravelly SAND (GS). Gravel, 20% sand 90% Gravel, pea-size to small pebbles, well sorted, R-SH. Sand, vfn-vco, poorly sorted, SR-SH. 45-50% basalt, 50-55% qtz (other) 10YR 4/2, dark greyish brown. No rxn HCL.	Becker Hammer 9" old Grab 60' archive
65	Grab Becker Hammer				Grab 65' archive
70	Grab Becker Hammer			70'-95' sand (S) 95% sand, 5% silt. SR-SH, poorly moderately sorted, vfn-vco. 30% basalt, 70% qtz (other) 10YR 5/4, yellowish brown, moist. No rxn HCL. Trace pea-sized gravel.	Grab 70' archive
75	Grab Becker Hammer				Grab 75' archive
80	Grab Becker Hammer			@ 80' sand, 92% silt & b. sand, well sorted, vfn-vco, SR-SH. 30% basalt, 70% qtz (other). 10YR 5/4 yellowish brown, moist. No rxn HCL.	Grab 80' archive
85	Grab Becker Hammer				Grab 85' archive

Reported By: Charlene Martinez

Reviewed By: L.D. Walker

Title: Geologist/Scientist

Title: Geologist

Signature: Charlene Martinez

Date: 11/19/02

Signature: L.D. Walker

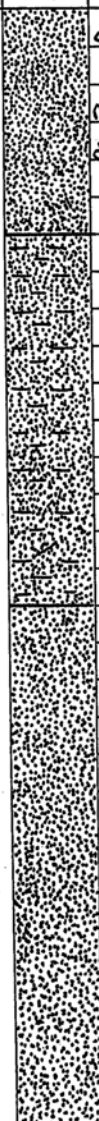
Date: 12/11/02

Original to: Document and Information Services, H0-09/HWIS

BOREHOLE LOG

Page: 4 of 13

Date: 11/19/02

Well ID: C3958		Well Name: 299-W19-46		Location: S.E. of U-Plant	
Project: RCRA Drilling (CERCLA well)				Reference Measuring Point: Ground Surface	
Depth [Ft.]	Sample		Graphic Log	Sample Description	Comments:
	Type & No.	Blows & Recovery			
90	Becker Hammer Grab Becker Hammer	N/A		95'-105' silty SAND (ms) 20% silt, 30% sand. Sand, vfn-med, v. well sorted bn-basaltic. 10.5 YR 6/3 pale brown, dry. no rxn HCL.	Becker Hammer 90' ID Grab 90' archive
95	Grab Becker Hammer				Grab 95' archive A.M. RCT ck at 95' @ background
100	Grab Becker Hammer				Grab 100' archive A.M. I.H.C. Spoil pile (0-100') readings (organics) from 3.3-4.3 ppm.
105	Grab Becker Hammer			105'-130' Sand (cm) (S) Sand, 5% silt. Sand, vfn-vco, poorly sorted, 45% basalt, 30% SA, 10% R 6/2 light brownish gray (dry) No rxn HCL.	Grab 105' archive After 100' spoils not drummed.
110	Grab Becker Hammer				Grab 110' archive
115	Grab Becker Hammer			115' Sand, vfn-med, well sorted	Grab 115' archive

Reported By: Charlene Martinez

Reviewed By: L.D. Walker

Title: Geologist/Scientist

Title: Geologist

Signature: Charlene Martinez

Date: 11/19/02

Signature: L.D. Walker

Date: 12/11/02

Original to: Document and Information Services, H0-09/HWIS

Page: 5 of 13

Date: 11/19/03

Well ID: C 3958

Well Name: 299-W19-430

Location: S.E. of U-plant

Project: RCRA Drilling (CERCLA well)

Reference Measuring Point: Ground Surface

Reported By: Charlene Martinez

Reviewed By: L. D. Walker

Title: Geologist/Scientist

Title: Geologist

Signature: *[Handwritten Signature]*

Date: 11/19/02

Signature: *R. D. Walker*

Date: 12/11/02

Original to: Document and Information Services, H0-09/HWIS

BOREHOLE LOG

Page: 10 of 13

Date: 11/19/02

Well ID: C3958 Well Name: 299-W19-46 Location: S.E. of U-Plant
Project: RCRA Drilling (CERCLA well) Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample		Graphic Log	Sample Description Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
	Type & No.	Blows & Recovery			
145	Becker Hammer Grab Becker Hammer	N/A		155'-160' SAND(S) 95% sand, 5% silt. Sand SR-SR, poorly sorted, vfn-v. cse, basaltic (45-50%) qtz (other) 50-55% 10YR 6/12, light brownish gray (dry). no rxn HCL.	Becker Hammer 9' old Grab 145' archive
150	Grab Becker Hammer				Grab 150' archive
155	Grab Becker Hammer				Grab 155' archive
160	Grab Becker Hammer			160'-165' Silty SAND (ms) 20% silt, 80% sand. Sand, vfn-fn. non-basaltic micaceous 10YR 6/14, light yellowish brown, dry. v. well sorted No rxn HCL.	Grab 160' archive
165	Grab Becker Hammer			165'-170' SAND(S). Similar to 155'-160' interval. No rxn HCL.	Grab 165' archive
170	Grab Becker Hammer			170'-185' Silty SAND (ms) 20% silt, 80% sand, Sand, SR-R, vfn-fn, micaceous, non-basaltic. 10YR 6/14, 12, yellowish brownish (dry). Strong rxn HCL.	Grab 170' archive Top of Cold Creek Unit

Reported By: Charlene Martinez

Reviewed By: L.D. Walker

Title: Geologist/Scientist

Title: Geologist

Signature: Charlene Martinez

Date: 11/19/02

Signature: L.D. Walker

Date: 12/11/02

Original to: Document and Information Services, H0-09/HWIS

BOREHOLE LOG						Page: <u>7</u> of <u>13</u>
						Date: <u>11/19/02</u>
Well ID: <u>C3958</u>		Well Name: <u>299-W19-46</u>		Location: <u>S.E. of U-Plant</u>		
Project: <u>RCRA Drilling (CERCLA well)</u>				Reference Measuring Point: <u>Ground Surface</u>		
Depth (Ft)	Sample Type & No.	Blows & Recovery	Graphic Log	Sample Description Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
175	Becker Hammer	n/a		185'-190' SILT (m) 100% non basaltic	Becker Hammer 9" old	
	Grab Becker Hammer			2.5 Y 6/3 light yellowish brown. Strong rxn HCL.	Grab 175' archive.	
				Trace caliche @ 187' bgs.		
180	Grab Becker Hammer			190'-200' CALICHE. 75% silt, 25% sand, some massive caliche. non-basaltic	Grab 180' archive	
				Overall color, 2.5 Y 6/4 light yellowish brown (dry) caliche 10 R 8/2 pinkish white (dry) Strong rxn HCL.		
185	Grab Becker Hammer				Grab 185' archive	
				200'-205' Silty SAND (m.s) 15% silt, 85% sand, trace caliche. Sand, SR-R, vfn-med. well sorted, non-basaltic.		
190	Grab Becker Hammer			2.5 Y 6/4 light yellowish brown (dry)	Grab 190' archive	
				205'-210' Sandy SILT (sm) 25% sand, 75% silt. Sand, R, v. well sorted, vfn-fn		
195	Grab Becker Hammer			non basaltic. 2.5 Y 6/3 light yellowish brown (dry). Weak to moderate rxn HCL	Grab 195' archive Trace caliche @ 191' bgs	
200	Grab Becker Hammer				Grab 200' archive	

Reported By: <u>Charlene Martinez</u>		Reviewed By: <u>L.D. Walker</u>	
Title: <u>Geologist/Scientist</u>		Title: <u>Geologist</u>	
Signature: <u>Charlene Martinez</u>	Date: <u>11/19/02</u>	Signature: <u>L.D. Walker</u>	Date: <u>12/11/02</u>
Original to: Document and Information Services, H0-09/HWIS			

BOREHOLE LOG					Page: <u>8</u> of <u>13</u>
					Date: <u>11/19/02</u>
Well ID: <u>C3958</u>		Well Name: <u>299-W19-46</u>		Location: <u>S.E. of U-Plant</u>	
Project: <u>RCRA Drilling (CERCLA well)</u>				Reference Measuring Point: <u>Ground Surface</u>	
Depth (Ft.)	Sample		Graphic Log	Sample Description	
	Type & No.	Blows & Recovery		Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	
Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level					
205	Becker Hammer Grab Becker Hammer	N/A		210'-230' SILT 95% silt, 5% sand. Sand, vfn. very well sorted, rounded, non-basaltic, micaceous. 2.54/13 light yellowish brown. No rxn HCL.	
210	Grab Becker Hammer			Grab 210' archive	
215	Grab Becker Hammer			Grab 215' archive	
220	Grab Becker Hammer			230'-235' Silty SAND (MS) 10% silt, 90% sand. Clay lenses. Sand, R, vfn-fn v. well sorted; non basaltic, micaceous. Clay - med plasticity, Fe oxide staining. 2.54/14 light olive brown. No rxn HCL.	
225	Grab Becker Hammer			Grab 225' archive	
230	Grab Becker Hammer			Grab 230' archive	

Reported By: <u>Charlene Martinez</u>		Reviewed By: <u>L.D. Walker</u>	
Title: <u>Geologist/Scientist</u>		Title: <u>Geologist</u>	
Signature: <u>Charlene Martinez</u>	Date: <u>11/19/02</u>	Signature: <u>L.D. Walker</u>	Date: <u>12/11/02</u>

Original to: Document and Information Services, H0-09/HWIS

BOREHOLE LOG

Page: 9 of 13

Date: 11/19/02

Well ID: C3958 Well Name: 299-1019-46 Location: S.E. of U-Plant
Project: RCRA Drilling (CERCLA well) Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample		Graphic Log	Sample Description Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
	Type & No.	Blows & Recovery			
235	Becker Hammer Grab	N/A		235-245' SAND(s) 95% sand, 5% silt. Becker Hammer 9" old	Grab 235' archive
240	Becker Hammer Grab			Sand SR-R, med grained, well sorted, micaceous, non-basaltic. 10YR 4/3 pale brown (moist) no rxn HCL.	Grab 240' archive
245	Becker Hammer Grab			245-253' gravelly SAND. 15% gravel, 5% silt, 80% sand. Gravel, sm-large pebbles, mod sorted. Sand, med-cse, SR-SA, mod sorted, non basaltic. 10YR 5/4 yellowish brown (moist), micaceous. no rxn HCL.	Grab 245' archive
250	Becker Hammer Grab			253-257' SAND(s) 95% sand, 5% silt. Sand, med-cse, SR-SA, mod sorted, micaceous, non basaltic. 10YR 5/4 yellowish brown, moist. no rxn HCL	Grab 250' archive
255	Becker Hammer Grab			* should be Sand graphics (LOW)	Static 6.10 @ 255.42' (12/02/02)
260	Becker Hammer Grab			257-305' sandy GRAVEL (SG) 55% gravel, 40% sand, 5% silt. Gravel, R-A, pea-size to sm cobbles, poorly sorted, 25-30% basalt, 70-75% qtz (other). Sand, SR-SA, med-cse, moderately sorted, micaceous, 25% basalt, 25% qtz (other) 2.5 Y 5/3 light olive brown (moist). no rxn HCL.	Grab 260' archive
265	Becker Hammer Grab				P.m. IHC, organics ~3.3 ppm. P.m. RCT ck. 1, 3, 8 @ background
270	Becker Hammer Grab				Grab 260' archive
275	Becker Hammer Grab				S.S. for PNNL @
280	Becker Hammer Grab				260'-262.5' bgs.

Reported By: Charlene Martinez

Reviewed By: L.A. Walker

Title: Geologist/Scientist

Title: Geologist

Signature: Charlene Martinez

Date: 11/19/02

Signature: L.A. Walker

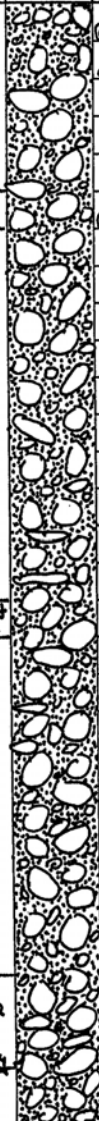
Date: 12/11/02

Original to: Document and Information Services, H0-09/HWIS

BOREHOLE LOG

Page: 10 of 13

Date: 11/19/02

Well ID: C3958		Well Name: 299-W19-410		Location: S.E. of U-Plant	
Project: RCRA Drilling (CERCLA Well)			Reference Measuring Point: Ground Surface		
Depth (Ft.)	Sample		Graphic Log	Sample Description	Comments:
	Type & No.	Blows & Recovery			
265	Becker Hammer	N/A		@ 265' sandy gravel. Same description as 257'. Sample wet.	Becker Hammer 9" old Grab 265' archive
	Grab				
	Becker Hammer				
270	Becker Hammer	N/A			@ 270' sandy gravel. Gravel, v poorly sorted, 45-70% sand, 25-30% gravel, pea-size cobbles, SR-A, sand poorly sorted SR-SA, vfn-v-cse. Sample wet.
	Grab				
	Becker Hammer				
275	Becker Hammer				Grab 275' archive
	Grab				
	Becker Hammer				

Reported By: Charlene Martinez

Reviewed By: L.D. Walker

Title: Geologist/Scientist

Title: Geologist

Signature: Charlene Martinez

Date: 11/19/02

Signature: L.D. Walker

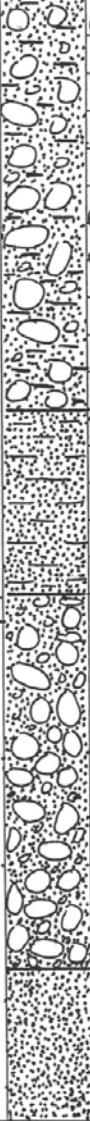
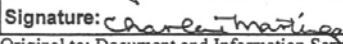
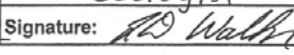
Date: 12/11/02

Original to: Document and Information Services, HO-09/HWIS

BOREHOLE LOG						Page: <u>11</u> of <u>13</u>
						Date: <u>11/20/02</u>
Well ID: <u>C3958</u>		Well Name: <u>299-W 19-46</u>		Location: <u>S.E. of U-Plant</u>		
Project: <u>REBA Drilling (CERCLA well)</u>				Reference Measuring Point: <u>Ground Surface</u>		
Depth (Ft.)	Sample		Graphic Log	Sample Description	Comments:	
	Type & No.	Blows & Recovery		Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
295	Becker Hammer Grab Becker Hammer	N/A		@ 295' sandy GRAVEL. Similar description as 285' (page 10)	Becker Hammer #101D Grab 295' archive	
300	Grab Becker Hammer	Pump + Purge G.W. N/A			Grab 300' archive Pump + Purge G.W. Sample for PNNL (300')	
305	Grab Becker Hammer			305'-335' silty sandy GRAVEL (msG) 10% gravel, 30% sand, 10% silt Gravel, poorly sorted, sm pebbles-med. cobbles, 45% basalt, R-A. Sand, ufn-vase, SR-SA, poorly sorted, 45% basalt, 55% qtz (other). Sample = slurry	Grab 305' archive	
310	Grab Becker Hammer			micaceous, some cementation (Fe oxide)	Grab 310' archive	
315	Grab Becker Hammer				Grab 315' archive	
320	Grab Becker Hammer	Air-lifted g.w. N/A		@ 320' more visible Fe oxide staining + cementation on gravel. mps ~ 5.5"	Grab 320' archive Air lift g.w. sample for PNNL (320' bgs)	

Reported By: <u>Charlene Martinez</u>		Reviewed By: <u>L.D. Walker</u>	
Title: <u>Geologist/Scientist</u>		Title: <u>Geologist</u>	
Signature: <u>Charlene Martinez</u>	Date: <u>11/20/02</u>	Signature: <u>L.D. Walker</u>	Date: <u>12/11/02</u>

Original to: Document and Information Services, H0-09/HWIS

BOREHOLE LOG					Page: 12 of 13
					Date: 11/20/02
Well ID: C3958		Well Name: 299-1019-46		Location: S.E. of U-Plant	
Project: RCEA Drilling (CERCLA well)				Reference Measuring Point: Ground Surface	
Depth (Ft.)	Sample Type & No.	Blows & Recover y	Graphic Log	Sample Description	Comments:
				Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
325	Becker Hammer Grab Becker Hammer	n/a		@ 325' silty sandy GRAVEL, see page 11	Becker Hammer 9" old Grab 325' archive
330	Grab Becker Hammer			@ 330' Gravel, 70% mod. sorted, pre-size to med. pebbles. Sand, vfn-cse, mod. sorted, 15% silt 15%.	Grab 330' archive
335	Grab Becker Hammer			Still silty sandy GRAVEL 335'-340' silty SAND (ms) 15% silt, 85% sand. Sand, vfn-vcs, SR-SA mod. sorted 50% basalt, 50% qtz (other). Sample, viscous slurry.	Grab 335' archive P.M. IN ck: 1.7-33pm in casing (organics) P.M. RCT ck d/s. @ background
340	Grab Becker Hammer	Purser Pump 6W n/a		340'-350' Sandy GRAVEL (SG) 70% gravel, 23% sand, 7% silt. Gravel, R-A, v. poorly sorted, sm pebbles-med cobbles. Sand, vfn-vcs, SR-SA, poorly sorted. 45-50% basalt, 50-55% qtz (other) sample wet.	Grab 340' archive Purser Pump 6W, E.O.S. @ 340 bgs (11/20/02) Start 11/21/02
345	Grab Becker Hammer				Grab 345' archive
350	Grab Becker Hammer			350'-355' SAND (S) 95% sand, 5% silt, trace gravel. Sand, SR-SA, vfn-vcs, poorly sorted. 50% basalt, 50% qtz (other) Sample - slurry.	Grab 350' archive
Reported By: charlene martinez				Reviewed By: L.D. Walker	
Title: Geologist/Scientist				Title: Geologist	
Signature: 		Date: 11/20/02		Signature:  Date: 12/11/02	
Original to: Document and Information Services, H0-09/HWIS					

BOREHOLE LOG					Page: <u>13</u> of <u>13</u>
					Date: <u>11/21/02</u>
Well ID: <u>C3958</u>		Well Name: <u>299-W19-416</u>		Location: <u>S.E. of U- Plant</u>	
Project: <u>RCRA Drilling (CERCLA well)</u>				Reference Measuring Point: <u>Ground Surface</u>	
Depth (Ft.)	Sample Type & No.	Blows & Recovery	Graphic Log	Sample Description Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
355	Becker Hammer Grab Becker Hammer	N/A		355' - 376' silty GRAVEL (SG) 70% gravel, 25% sand, 5% silt. Gravel, R-A, sm pebbles - sm cobbles, v. poorly sorted. Sand, SR-SA, vfn-vse, poorly sorted. 45-50% basalt, 50-55% gtz (other) sample - wet. Some visible cementation	Becker Hammer 9' old Grab 355' archive
360	Grab Becker Hammer	Air lift g.w. N/A			Grab 360' archive Collect 360' g.w. sample for PNH
365	Grab Becker hammer			376' - 379' silty sandy GRAVEL (MSG) 60% gravel, 20% sand, 20% silt. Gravel, R-A, poorly sorted, pea-size - sm. cobbles. Sand, SR-SA, vfn-vse, poorly sorted. Cementation. Silt stone present. No rxn HCL.	Grab 365' archive
370	Grab Becker hammer				Grab 370' archive A.M. I.H.E.K organics 5.5 ppm in casing @ 370' bgs
375	Grab Becker hammer				Grab 375' archive
380	Grab Becker hammer				Grab 379' archive (70) 379' purge & pump sample collected for PNH
385	Grab Becker hammer				
390	Grab Becker hammer				
395	Grab Becker hammer				
400	Grab Becker hammer				

Reported By: Charlene Martinez

Reviewed By: L.D. Walker

Title: Geologist/Scientist

Title: Geologist

Signature: Charlene Martinez

Date: 11/21/02

Signature: L.D. Walker

Date: 12/11/02

Original to: Document and Information Service, H0-09/HWIS

Appendix B

Physical Properties Data

Appendix B

Physical Properties Data

This appendix includes the results of testing for particle size distribution on grab samples from well 299-W19-46. The particle size analyses were done by CH2M Hill Hanford, Inc. using standard sieve techniques.

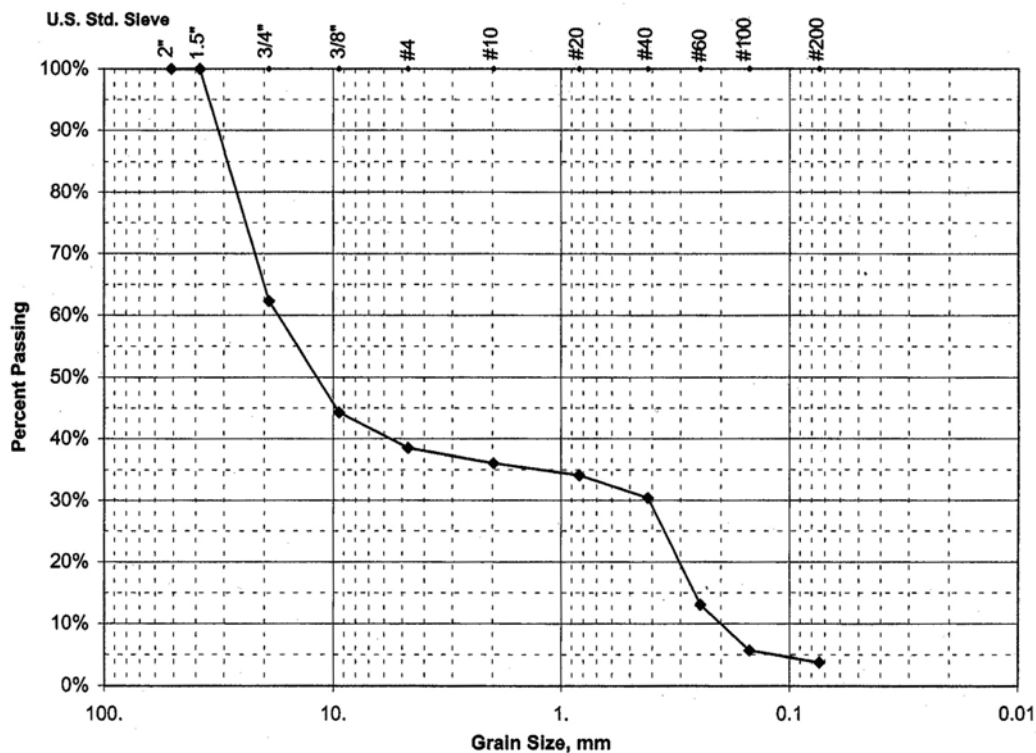
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W19-46	DEPTH	260	SAMPLE#	W19-46-260.0	WELL ID#	C3958
TESTED BY	CRM	CONTACT	Dave Weekes	PHONE	372-9350	DATE	12/10/2002

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1394.00	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	525.5	37.7	62.3	19.05	
	3/8"	776.6	55.7	44.3	9.42	
	#4	857.3	61.5	38.5	4.70	
	#10	891.1	63.9	36.1	1.98	
	#20	918.5	65.9	34.1	0.83	
	#40	970.5	69.6	30.4	0.42	
	#60	1211.7	86.9	13.1	0.25	
	#100	1314.7	94.3	5.7	0.150	
	#200	1341.4	96.2	3.8	0.074	

Sieve Analysis Data for Sample W19-46-260.0



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: L.D. Walker

Date: 12/13/02

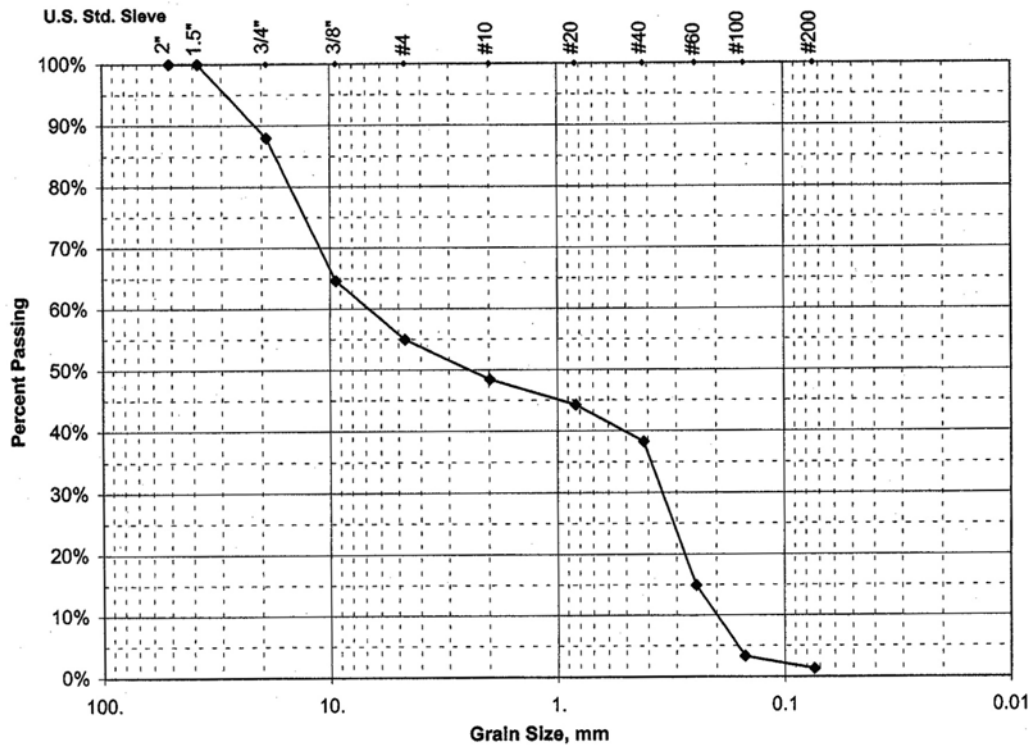
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W19-46	DEPTH	290	SAMPLE#	W19-46-290.0	WELL ID#	C3958
TESTED BY	CRM	CONTACT	Dave Weekes	PHONE	372-9350	DATE	12/10/2002

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1344.00	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	162.0	12.1	87.9	19.05	
	3/8"	475.5	35.4	64.6	9.42	
	#4	605.6	45.1	54.9	4.70	
	#10	693.2	51.6	48.4	1.98	
	#20	749.5	55.8	44.2	0.83	
	#40	830.4	61.8	38.2	0.42	
	#60	1143.5	85.1	14.9	0.25	
	#100	1299.4	96.7	3.3	0.150	
	#200	1326.9	98.7	1.3	0.074	

Sieve Analysis Data for Sample W19-46-290.0



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: L.D. Walker

Date: 12/13/02

Appendix C

Groundwater Composition Data

Appendix C

Groundwater Composition Data

This appendix includes the results of laboratory analyses of groundwater samples collected during drilling of well 299-W19-46. All analyses were done by the Hanford Groundwater Monitoring Project's contracted analytical laboratories. All data are available in the Hanford Environmental Information System. The qualifiers in the following table are defined as D = dilution factor different than 1; U = undetected; C = analyte was detected in both the sample and the QC blank and the sample concentration was less than 5 times the blank concentration; B = the analyte was detected at a value less than the contract required detection limit but greater than or equal to the method detection limit; J = the reported value is an estimate; N = spike sample recovery is outside control limits; Q = associated quality control is out of limits; bgs = below ground surface.

Well Name	Sample Number	Sample Date	Constituent	Concentration	Laboratory Qualifier	Review Qualifier	Sample Depth (ft)	Comments
299-W19-46	B15P94	11/20/2002	1,1,1-Trichloroethane	0.17 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	1,1,1-Trichloroethane	0.17 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	1,1,1-Trichloroethane	0.17 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	1,1,1-Trichloroethane	0.17 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	1,1,2-Trichloroethane	0.05 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	1,1,2-Trichloroethane	0.05 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	1,1,2-Trichloroethane	0.05 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	1,1,2-Trichloroethane	0.05 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	1,1-Dichloroethane	0.2 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	1,1-Dichloroethane	0.2 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	1,1-Dichloroethane	0.2 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	1,1-Dichloroethane	0.2 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	1,2-Dichloroethane	0.08 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	1,2-Dichloroethane	0.08 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	1,2-Dichloroethane	0.08 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	1,2-Dichloroethane	0.08 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	1,4-Dichlorobenzene	0.11 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	1,4-Dichlorobenzene	0.11 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	1,4-Dichlorobenzene	0.11 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	1,4-Dichlorobenzene	0.11 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	1-Butanol	4.6 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	1-Butanol	4.6 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	1-Butanol	9.8 µg/L	J		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	1-Butanol	4.6 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	2-Butanone	0.29 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	2-Butanone	0.29 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	2-Butanone	0.29 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	2-Butanone	0.29 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	4-Methyl-2-Pentanone	0.35 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	4-Methyl-2-Pentanone	0.35 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	4-Methyl-2-Pentanone	0.35 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	4-Methyl-2-Pentanone	0.35 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Acetone	2.7 µg/L	JB		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Acetone	2.4 µg/L	JB		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Acetone	7.5 µg/L	JB		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.

Well Name	Sample Number	Sample Date	Constituent	Concentration	Laboratory Qualifier	Review Qualifier	Sample Depth (ft)	Comments
299-W19-46	B15P98	11/21/2002	Acetone	2.3 µg/L	JB		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Aluminum	34.9 µg/L	B		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Aluminum	11.2 µg/L	U		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Aluminum	19.9 µg/L	B		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Aluminum	11.2 µg/L	U		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Aluminum	17 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Aluminum	11.2 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Aluminum	17 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Antimony	22.8 µg/L	U		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Antimony	22.8 µg/L	U		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Antimony	29.5 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Antimony	22.8 µg/L	U		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Antimony	29.5 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Antimony	22.8 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Antimony	29.5 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Barium	36 µg/L	B		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Barium	35.4 µg/L	B		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Barium	36 µg/L	B		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Barium	71.4 µg/L	B		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Barium	52.2 µg/L	B		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Barium	33.8 µg/L	B		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Barium	44 µg/L	B		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Benzene	0.07 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Benzene	0.07 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Benzene	0.07 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Benzene	0.07 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Beryllium	0.29 µg/L	B		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Beryllium	0.37 µg/L	B		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Beryllium	0.86 µg/L	B		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Beryllium	0.77 µg/L	B		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Beryllium	0.87 µg/L	B		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Beryllium	0.48 µg/L	B		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Beryllium	0.68 µg/L	B		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Cadmium	2.5 µg/L	U		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Cadmium	2.5 µg/L	U		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.

Well Name	Sample Number	Sample Date	Constituent	Concentration	Laboratory Qualifier	Review Qualifier	Sample Depth (ft)	Comments
299-W19-46	B15PB1	11/20/2002	Cadmium	2.5 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Cadmium	2.5 µg/L	U		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Cadmium	2.5 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Cadmium	2.5 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Cadmium	2.5 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Calcium	40,500 µg/L			269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Calcium	35,100 µg/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Calcium	39,100 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Calcium	71,400 µg/L			320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Calcium	54,300 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Calcium	40,000 µg/L			360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Calcium	42,400 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Carbon disulfide	0.43 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Carbon disulfide	0.43 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Carbon disulfide	0.43 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Carbon disulfide	0.43 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Carbon tetrachloride	98 µg/L	DN		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Carbon tetrachloride	46 µg/L	DN		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Carbon tetrachloride	0.15 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Carbon tetrachloride	75 µg/L	D		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P95	11/19/2002	Chloride	11,500 µg/L	CD	Q	269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15P97	11/19/2002	Chloride	8,100 µg/L	CD	Q	280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15P94	11/20/2002	Chloride	8,600 µg/L	CD		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P99	11/20/2002	Chloride	15,700 µg/L	CD		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15P96	11/20/2002	Chloride	17,600 µg/L	CD		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Chloride	15,500 µg/L	CD		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Chloride	13,800 µg/L	CD		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Chloroform	2 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Chloroform	6.1 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Chloroform	0.07 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Chloroform	8 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Chromium	2.4 µg/L	U		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Chromium	2.4 µg/L	U		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Chromium	3.4 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Chromium	3.4 µg/L	B		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.

Well Name	Sample Number	Sample Date	Constituent	Concentration	Laboratory Qualifier	Review Qualifier	Sample Depth (ft)	Comments
299-W19-46	B15PB3	11/20/2002	Chromium	3.4 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Chromium	2.4 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Chromium	3.4 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	cis-1,2-Dichloroethylene	0.06 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	cis-1,2-Dichloroethylene	0.06 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	cis-1,2-Dichloroethylene	0.06 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	cis-1,2-Dichloroethylene	0.06 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Cobalt	2.2 µg/L	U	Q	269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Cobalt	2.2 µg/L	U	Q	280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Cobalt	5 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Cobalt	2.2 µg/L	U		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Cobalt	5 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Cobalt	2.2 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Cobalt	5 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Copper	2.6 µg/L	U		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Copper	2.6 µg/L	U		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Copper	0.86 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Copper	2.6 µg/L	U		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Copper	0.86 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Copper	2.6 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Copper	0.86 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Dissolved oxygen	5,520 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Dissolved oxygen	4,570 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15P98	11/21/2002	Dissolved oxygen	5,230 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Ethyl cyanide	1.3 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Ethyl cyanide	1.3 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Ethyl cyanide	1.3 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Ethyl cyanide	1.3 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Ethylbenzene	0.14 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Ethylbenzene	0.14 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Ethylbenzene	0.5 µg/L	J		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.

Well Name	Sample Number	Sample Date	Constituent	Concentration	Laboratory Qualifier	Review Qualifier	Sample Depth (ft)	Comments
299-W19-46	B15P98	11/21/2002	Ethylbenzene	0.14 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P95	11/19/2002	Fluoride	650 µg/L			269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15P97	11/19/2002	Fluoride	540 µg/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15P94	11/20/2002	Fluoride	560 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P99	11/20/2002	Fluoride	420 µg/L			320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15P96	11/20/2002	Fluoride	450 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Fluoride	480 µg/L			360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Fluoride	500 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB8	11/20/2002	Iodine-129	1.16 pCi/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PC0	11/20/2002	Iodine-129	0.489 pCi/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PC4	11/21/2002	Iodine-129	0.134 pCi/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PC2	11/21/2002	Iodine-129	0.31 pCi/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Iron	20.6 µg/L	B		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Iron	15.5 µg/L	B		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Iron	141 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Iron	30.5 µg/L	B		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Iron	125 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Iron	36.8 µg/L	B		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Iron	217 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Magnesium	13,300 µg/L			269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Magnesium	11,400 µg/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Magnesium	12,400 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Magnesium	22,600 µg/L			320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Magnesium	17,400 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Magnesium	13,400 µg/L			360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Magnesium	14,000 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Manganese	328 µg/L			269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Manganese	76.3 µg/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Manganese	11.1 µg/L	B		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Manganese	140 µg/L			320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Manganese	11.5 µg/L	B		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Manganese	106 µg/L			360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Manganese	12.6 µg/L	B		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Methylenechloride	0.3 µg/L	UN	Q	300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Methylenechloride	0.3 µg/L	UN	Q	340	C3958-3;Sample pumped during drilling from 340 feet bgs.

Well Name	Sample Number	Sample Date	Constituent	Concentration	Laboratory Qualifier	Review Qualifier	Sample Depth (ft)	Comments
299-W19-46	B15PB0	11/21/2002	Methylenechloride	0.3 µg/L	UN		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Methylenechloride	0.35 µg/L	JBN		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Nickel	13.1 µg/L	U		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Nickel	13.1 µg/L	U		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Nickel	15.8 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Nickel	13.1 µg/L	U		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Nickel	15.8 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Nickel	13.1 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Nickel	15.8 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P95	11/19/2002	Nitrate	55,800 µg/L	D		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15P97	11/19/2002	Nitrate	30,100 µg/L	D		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15P94	11/20/2002	Nitrate	35,400 µg/L	D		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P99	11/20/2002	Nitrate	179,000 µg/L	D		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15P96	11/20/2002	Nitrate	65,500 µg/L	D		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Nitrate	15,100 µg/L	D		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Nitrate	21,200 µg/L	D		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P95	11/19/2002	Nitrite	36.1 µg/L	U		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15P97	11/19/2002	Nitrite	36.1 µg/L	U		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15P94	11/20/2002	Nitrite	36.1 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P99	11/20/2002	Nitrite	36.1 µg/L	U		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15P96	11/20/2002	Nitrite	36.1 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Nitrite	36.1 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Nitrite	36.1 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	pH Measurement	7.869 pH			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	pH Measurement	7.814 pH			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15P98	11/21/2002	pH Measurement	7.607 pH			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B16DM9	2/18/2003	pH Measurement	7.74 pH				
299-W19-46	B15PB2	11/19/2002	Potassium	7,200 µg/L			269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Potassium	4,200 µg/L	B		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Potassium	3,750 µg/L	B		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Potassium	5,980 µg/L			320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Potassium	4,300 µg/L	B		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Potassium	2,430 µg/L	B		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Potassium	3,900 µg/L	B		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Silver	2.2 µg/L	U		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.

Well Name	Sample Number	Sample Date	Constituent	Concentration	Laboratory Qualifier	Review Qualifier	Sample Depth (ft)	Comments
299-W19-46	B15PB4	11/19/2002	Silver	2.2 µg/L	U		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Silver	1.7 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Silver	2.2 µg/L	U		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Silver	1.7 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Silver	2.2 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Silver	1.7 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Sodium	22,700 µg/L			269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Sodium	19,400 µg/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Sodium	18,900 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Sodium	18,900 µg/L			320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Sodium	14,500 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Sodium	13,700 µg/L			360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Sodium	13,200 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Specific Conductance	357 uS/cm			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Specific Conductance	453 uS/cm			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15P98	11/21/2002	Specific Conductance	395 uS/cm			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B16DM9	2/18/2003	Specific Conductance	364 uS/cm				
299-W19-46	B15PB2	11/19/2002	Strontium	181 µg/L			269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Strontium	160 µg/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Strontium	170 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Strontium	344 µg/L			320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Strontium	227 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Strontium	166 µg/L			360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Strontium	159 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P95	11/19/2002	Sulfate	34,800 µg/L	D		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15P97	11/19/2002	Sulfate	26,100 µg/L	D		280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15P94	11/20/2002	Sulfate	28,400 µg/L	D		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P99	11/20/2002	Sulfate	35,100 µg/L	D		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15P96	11/20/2002	Sulfate	34,500 µg/L	D		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Sulfate	23,400 µg/L	D		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Sulfate	23,800 µg/L	D		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB9	11/19/2002	Technetium-99	153 pCi/L			269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PC1	11/19/2002	Technetium-99	163 pCi/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB8	11/20/2002	Technetium-99	212 pCi/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PC3	11/20/2002	Technetium-99	1360 pCi/L			320	C3958-6;Sample air lifted during drilling from 320 feet bgs.

Well Name	Sample Number	Sample Date	Constituent	Concentration	Laboratory Qualifier	Review Qualifier	Sample Depth (ft)	Comments
299-W19-46	B15PC0	11/20/2002	Technetium-99	715 pCi/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PC4	11/21/2002	Technetium-99	55.7 pCi/L			360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PC2	11/21/2002	Technetium-99	215 pCi/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Temperature	20 Deg C			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Temperature	20.1 Deg C			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15P98	11/21/2002	Temperature	20.1 Deg C			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B16DM9	2/18/2003	Temperature	20.2 Deg C				
299-W19-46	B15P94	11/20/2002	Tetrachloroethene	0.17 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Tetrachloroethene	0.17 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Tetrachloroethene	0.17 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Tetrachloroethene	0.17 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Tetrahydrofuran	1.7 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Tetrahydrofuran	1.7 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Tetrahydrofuran	1.7 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Tetrahydrofuran	1.7 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Toluene	0.12 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Toluene	0.12 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Toluene	1.1 µg/L			360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Toluene	0.12 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	trans-1,2-Dichloroethylene	0.17 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	trans-1,2-Dichloroethylene	0.17 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	trans-1,2-Dichloroethylene	0.17 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	trans-1,2-Dichloroethylene	0.17 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Trichloroethene	0.46 µg/L	J		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Trichloroethene	2.1 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Trichloroethene	0.16 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Trichloroethene	4 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB9	11/19/2002	Tritium	264 pCi/L	U		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PC1	11/19/2002	Tritium	597 pCi/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB8	11/20/2002	Tritium	282 pCi/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PC3	11/20/2002	Tritium	42.8 pCi/L	U		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.

Well Name	Sample Number	Sample Date	Constituent	Concentration	Laboratory Qualifier	Review Qualifier	Sample Depth (ft)	Comments
299-W19-46	B15PC0	11/20/2002	Tritium	67.3 pCi/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PC2	11/21/2002	Tritium	66.7 pCi/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Turbidity	3.55 NTU			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Turbidity	43.1 NTU			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15P98	11/21/2002	Turbidity	7.16 NTU			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B16DM9	2/18/2003	Turbidity	0.72 NTU				
299-W19-46	B15PB9	11/19/2002	Uranium	23.4 µg/L			269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PC1	11/19/2002	Uranium	131 µg/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB8	11/20/2002	Uranium	134 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PC3	11/20/2002	Uranium	22.9 µg/L			320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PC0	11/20/2002	Uranium	2.26 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PC4	11/21/2002	Uranium	0.883 µg/L			360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PC2	11/21/2002	Uranium	1.57 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Vanadium	11.7 µg/L	B		269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Vanadium	20 µg/L			280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Vanadium	34.6 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Vanadium	15.5 µg/L	B		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Vanadium	32.1 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Vanadium	11.6 µg/L	B		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Vanadium	30.4 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Vinyl chloride	0.25 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Vinyl chloride	0.25 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Vinyl chloride	0.25 µg/L	U		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Vinyl chloride	0.25 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15P94	11/20/2002	Xylenes (total)	0.28 µg/L	U		300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15P96	11/20/2002	Xylenes (total)	0.28 µg/L	U		340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB0	11/21/2002	Xylenes (total)	2.6 µg/L	J		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15P98	11/21/2002	Xylenes (total)	0.28 µg/L	U		378	C3958-5;Sample pumped during drilling from 378 feet bgs.
299-W19-46	B15PB2	11/19/2002	Zinc	2.1 µg/L	B	Q	269	C3958-2;Sample air lifted during drilling from 269 feet bgs.
299-W19-46	B15PB4	11/19/2002	Zinc	1.6 µg/L	B	Q	280	C3958-4;Sample air lifted during drilling from 280 feet bgs.
299-W19-46	B15PB1	11/20/2002	Zinc	94.2 µg/L			300	C3958-1;Sample pumped during drilling from 300 feet bgs.
299-W19-46	B15PB6	11/20/2002	Zinc	1.6 µg/L	B		320	C3958-6;Sample air lifted during drilling from 320 feet bgs.
299-W19-46	B15PB3	11/20/2002	Zinc	160 µg/L			340	C3958-3;Sample pumped during drilling from 340 feet bgs.
299-W19-46	B15PB7	11/21/2002	Zinc	2 µg/L	B		360	C3958-7;Sample air lifted during drilling from 360 feet bgs.
299-W19-46	B15PB5	11/21/2002	Zinc	104 µg/L			378	C3958-5;Sample pumped during drilling from 378 feet bgs.

Appendix D

Borehole Geophysical Logs

Appendix D

Borehole Geophysical Logs

This appendix contains the borehole geophysical logs obtained from borehole 299-W19-46. The logs were run and analyzed by Stoller Inc. Analyses of the results are included with the logs.

299-W19-46 (C3958) Log Data Report

Borehole Information:

Borehole: 299-W19-46 (C3958)		Site: SW of 216-U-17 Crib			
Coordinates (WA State Plane)		GWL (ft): 256.0		GWL Date: 11/21/2002	
North N/A ³	East N/A	Drill Date Nov. 2002	TOC ² Elevation N/A	Total Depth (ft) 378	Type Becker

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	3.5	9	8	1/2	+3.5	378.0
Threaded Steel	3.5	6-1/4	6	1/8	+3.5	378.0

The well site geologist was the source for the casing depth and stickup information. The casing diameters and thicknesses were measured when possible.

Borehole Notes:

Well construction information is from measurements by Stoller personnel and the well site geologist. The well site geologist also supplied the depth to groundwater. Zero reference is the ground surface. The Becker drilling system utilizes a special dual-wall casing string. Air passes through the annular space between the inner and outer casings, and rill cuttings are brought up inside the inner casing. For this well, the casing consisted of a 6-in. ID inner casing with 0.125-in. wall thickness inside an 8-in. ID outer casing with 0.5-in. wall thickness. The inner casing is thicker at casing joints, where wall thickness is 0.406 in. Casing joints are approximately 1 ft long overall and occur at 10-ft intervals.

Logging Equipment Information:

Logging System:	Gamma 3E (RLS-1)	Type:	70% HPGe
Calibration Date:	10/2002	Calibration Reference:	GJO-2002-386-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 & Repeat	3	4	5
Date	11/21/02	11/25/02			
Logging Engineer	Pearson	Pearson			
Start Depth (ft)	0.0	380.0			
Finish Depth (ft)	199.0	160.0			
Count Time (sec)	100	100			
Live/Real	R	R			
Shield (Y/N)	None	None			
MSA Interval (ft)	1.0	1.0			

Log Run	1	2 & Repeat	3	4	5
ft/min	n/a	n/a			
Pre-Verification	CE051CAB	CE061CAB			
Start File	CE051000	CE061000			
Finish File	CE051199	CE061220			
Post-Verification	CE051CAA	CE061CAA			
Depth Return Error (in.)	0.0	0.25 low			
Comments	Fine gain adjustments at files CE051010, CE051113.	No fine gain adjustments.			

Logging Operation Notes:

Zero reference was the ground surface, and the borehole was logged through drill pipe. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the RLS employed the Amersham KUT (^{40}K , ^{238}U , and ^{232}Th) verifier with serial number 118.

Analysis Notes:

Analyst:	Sobczyk	Date:	12/09/02	Reference:	GJO-HGLP 1.6.3, Rev. 0
-----------------	---------	--------------	----------	-------------------	------------------------

RLS pre-run and post-run verification spectra were collected at the beginning and end of each day. File CE061CAA was within the control limits. The other three verification spectra were slightly above the control limit for the 609 keV full-width at half-maximum value, and file CE061CAB was slightly above the control limit for the 1461-keV full-width at half-maximum value. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were stable and between 1 and 4 percent of one another. Examinations of spectra indicate that the detector functioned normally during all of the logging runs, and the spectra are provisionally accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: RLS-1Oct02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the ground surface. Data were analyzed using a uniform casing correction based on the cumulative wall thickness of 0.625 in. for the dual wall casing. This correction was applied from 0.0 to 380.0 ft. The increase in casing thickness at the joints in the dual wall casing results in an apparent reduction in concentration, because the actual thickness increases to 0.9 in., but the casing correction is not changed. A water correction was applied to the RLS data below 256.0 ft. For the 70% HPGe detector, dead time at background count rates varies from 2 to 6 percent, averaging about 4 percent. This variation appears to be due to random fluctuation, as it does not correlate with count rate. The fluctuation is apparently an operational characteristic of the detector. Experiments with the detector in the calibration models indicate that the dead time is a function of count rate and that a dead time correction function similar to that developed for the SGLS can be used. Dead time values less than 10 percent should be ignored. Dead time corrections are required when dead time exceeds 18 percent. As the dead time did not exceed 18 percent, a dead time correction was not needed or applied.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , ^{238}U , and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are

included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

Man-made radionuclides were not detected in this borehole.

Recognizable changes in the KUT and total gamma logs occurred in this borehole. Starting at about 7 ft, decreases in total gamma and KUT concentrations occur every 10 ft at the casing joints in the dual wall casing. These concentration changes are due to an increase in gamma attenuation associated with the increase in casing thickness at the joints, rather than an actual change in activity. They are most apparent on the total gamma and ^{40}K (1461 keV) logs. At 40 ft, there is a 5-pCi/g increase in ^{40}K concentration. This increase in apparent ^{40}K concentration may correspond with the Hanford H2. Between 166 and 185 ft, the fine-grained member of the Cold Creek Unit (formerly known as the Early Palouse Soil) is shown by an increase in total gamma (50 cps) and ^{232}Th (0.5 pCi/g). A 10-pCi/g decrease in ^{40}K concentration and a 1.0-pCi/g decrease in ^{232}Th concentration occur at 185 ft. On the basis of low ^{40}K and ^{232}Th concentrations, the carbonate-rich paleosols of the Cold Creek Unit are interpreted as being between 185 and 209 ft.

The plots of the repeat logs demonstrate good repeatability of the RLS data for the natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV.

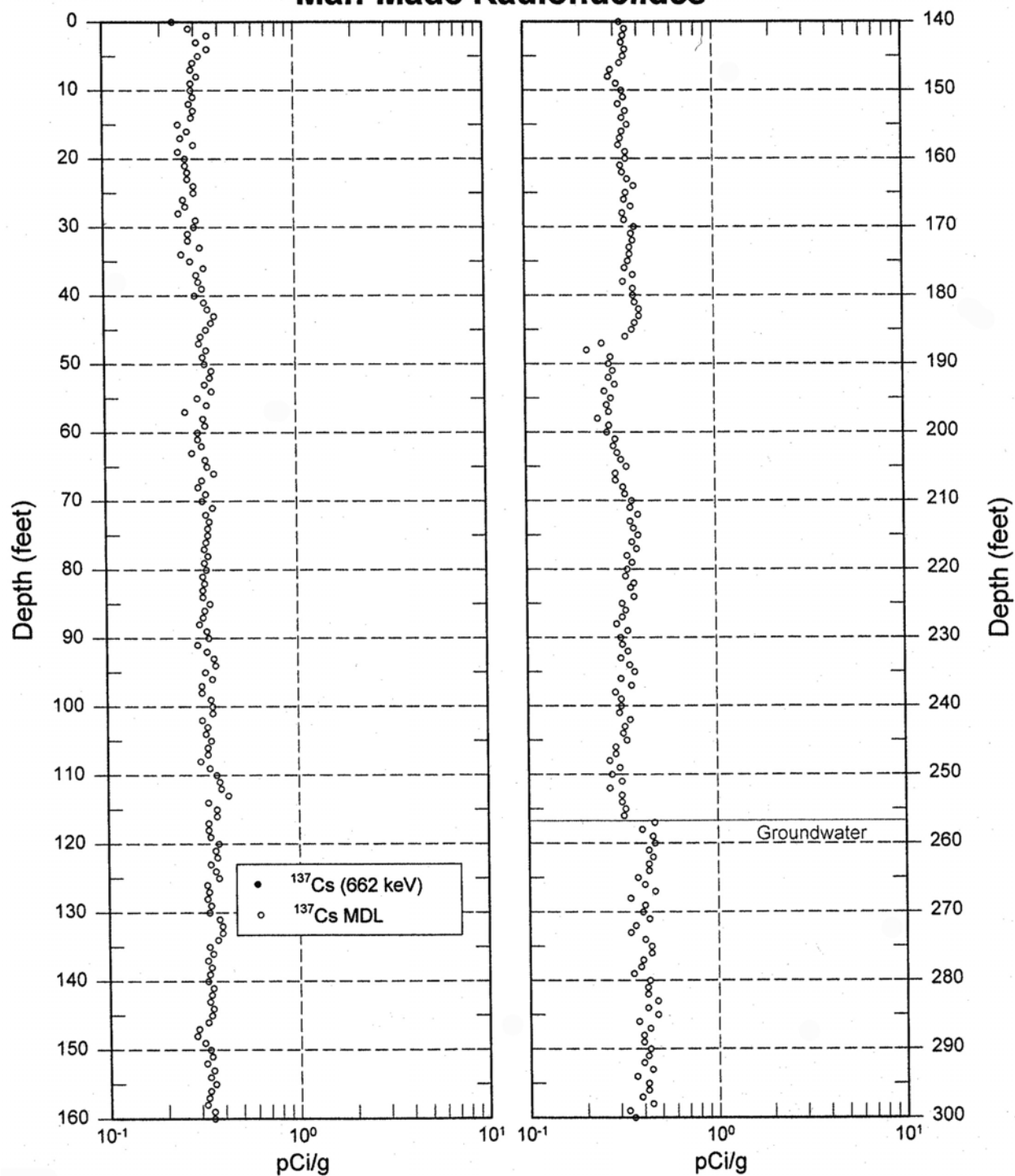
¹ GWL – groundwater depth

² TOC – top of casing

³ N/A – not available

⁴ n/a – not applicable

299-W19-46 (C3958) **Man-Made Radionuclides**

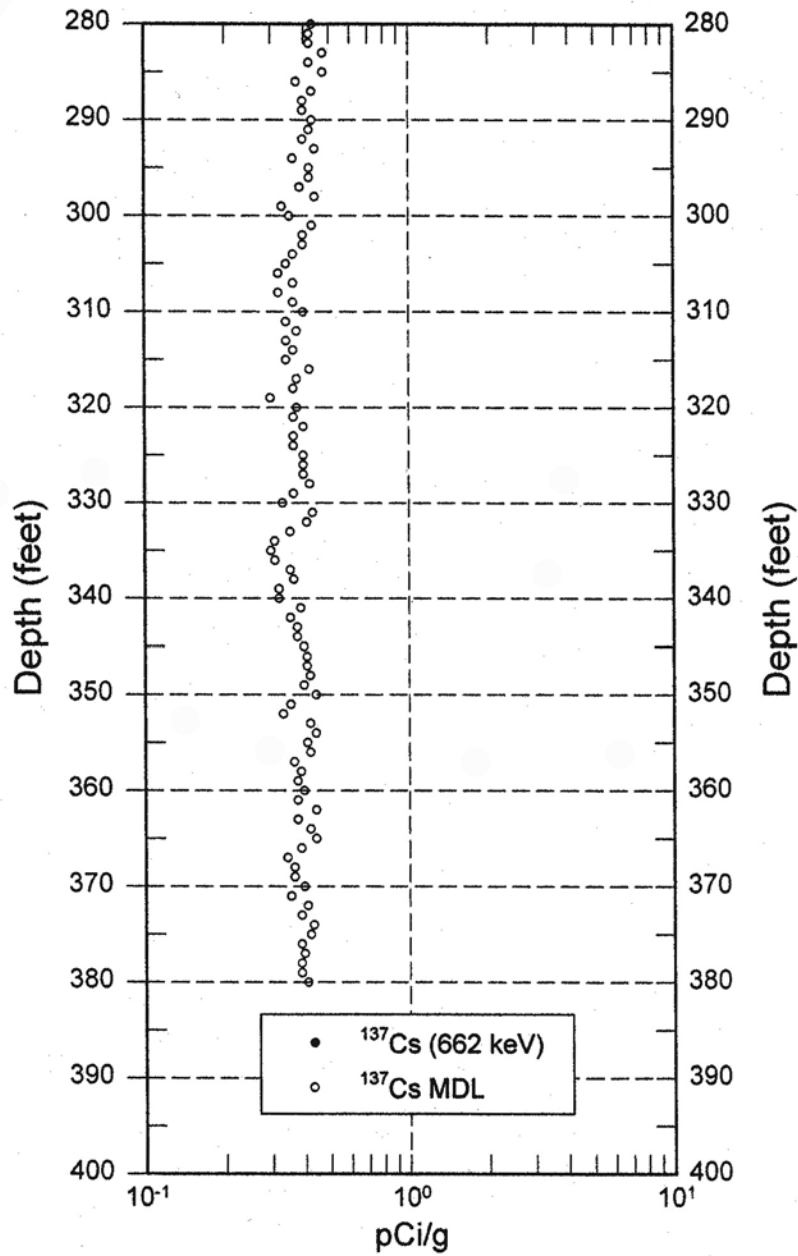


Zero Reference = Ground Surface

Date of Last Logging Run
 11/25/2002

299-W19-46 (C3958)

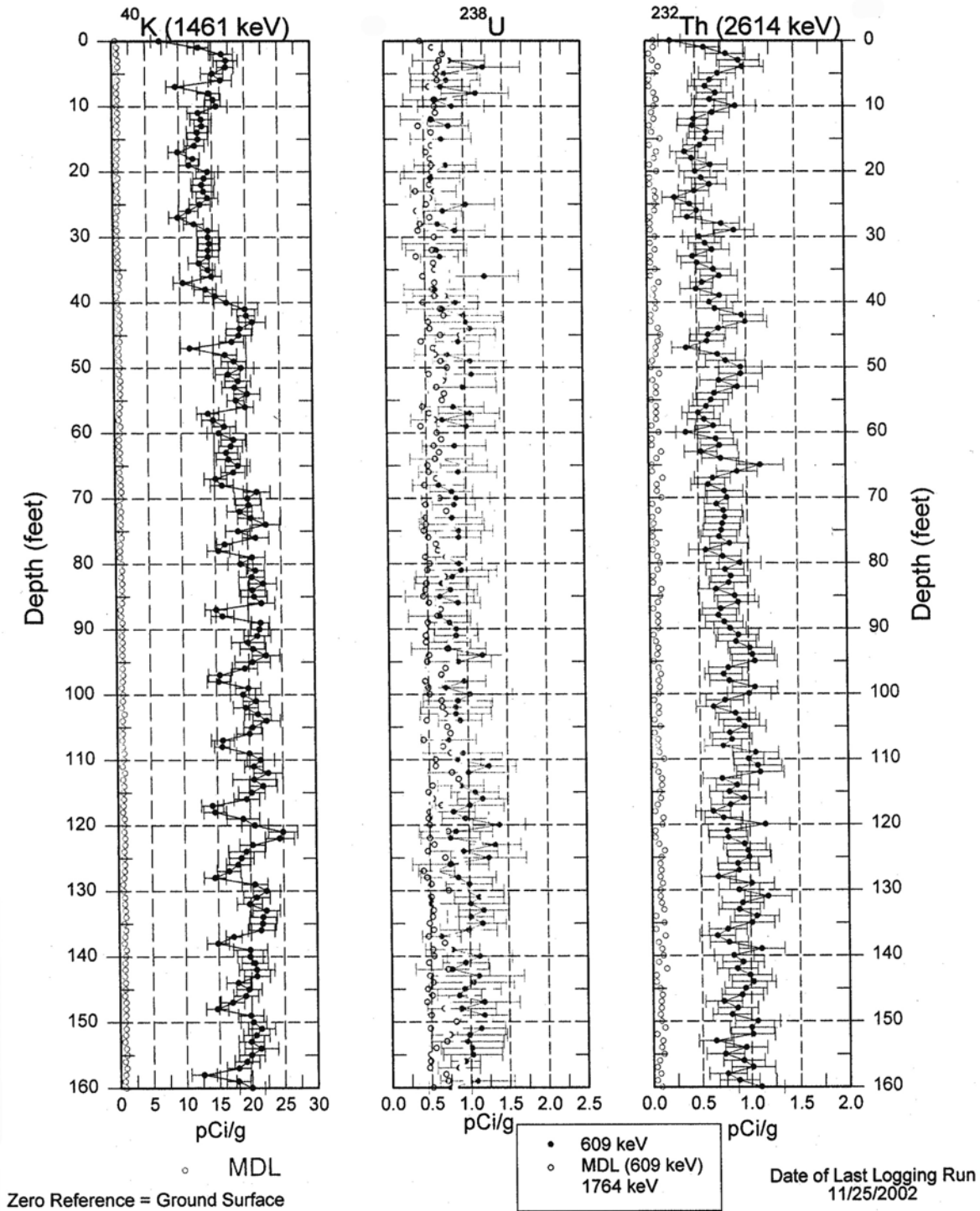
Man-Made Radionuclides



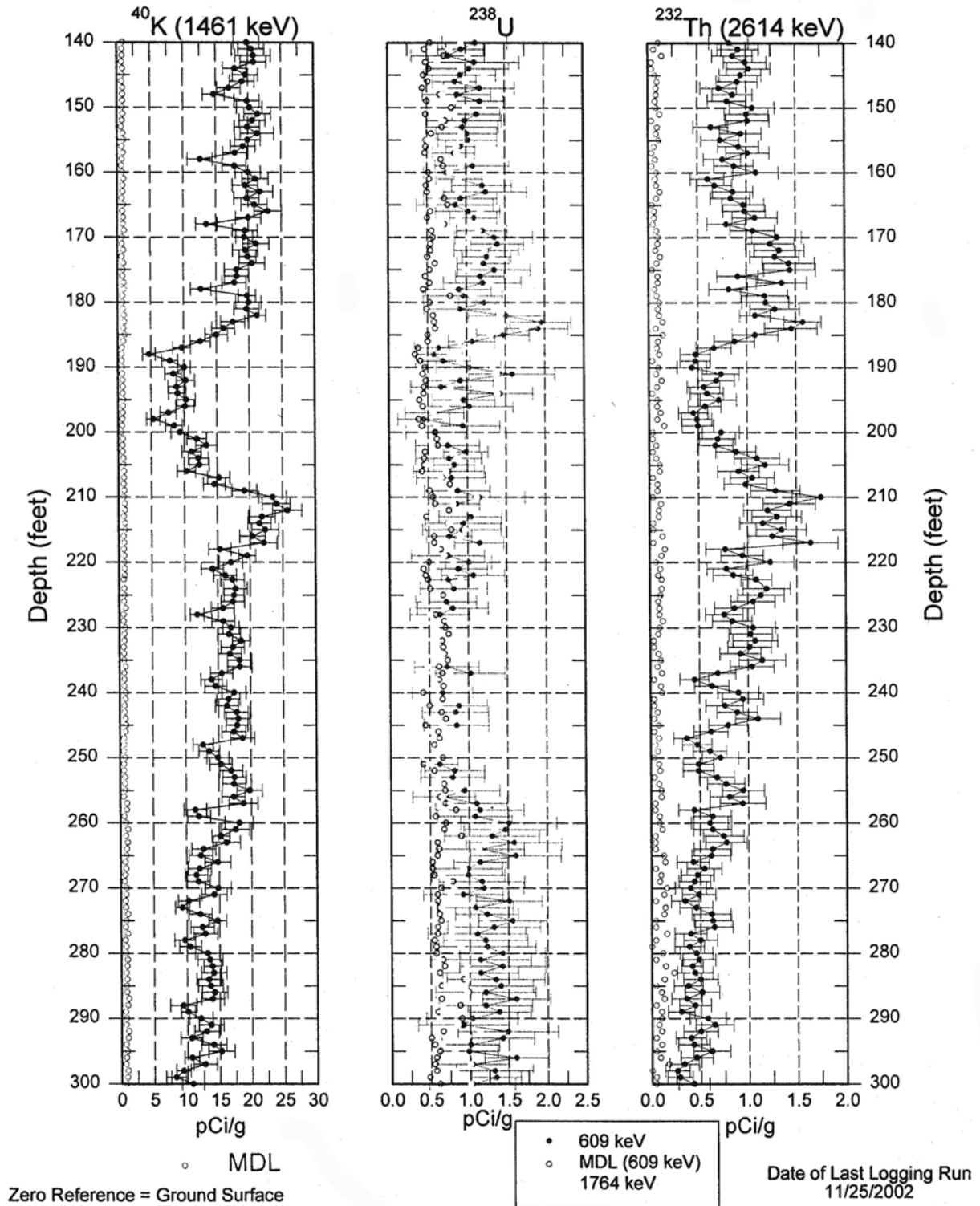
Zero Reference = Ground Surface

Date of Last Logging Run
11/25/2002

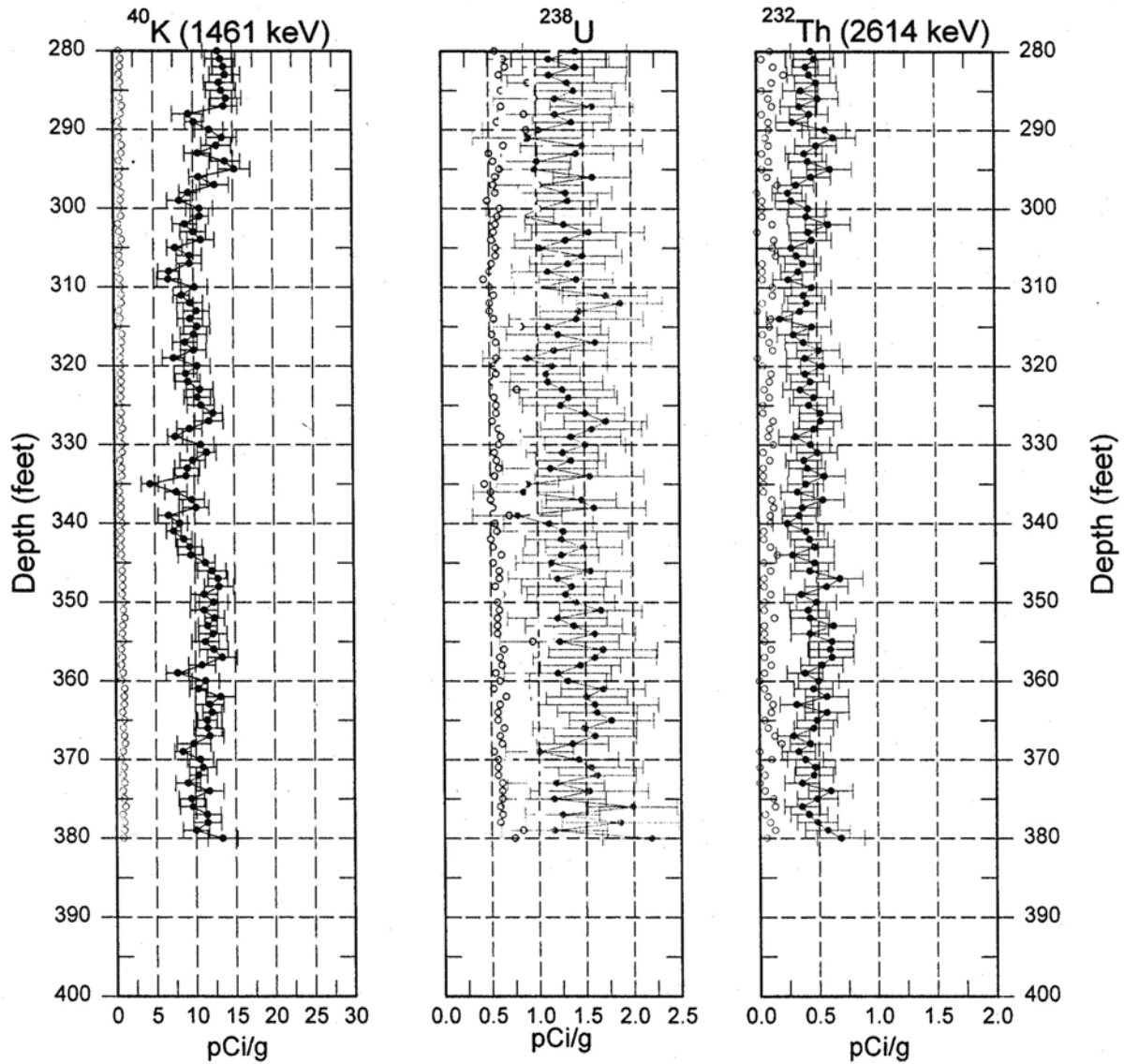
299-W19-46 (C3958) Natural Gamma Logs



299-W19-46 (C3958) Natural Gamma Logs



299-W19-46 (C3958) Natural Gamma Logs



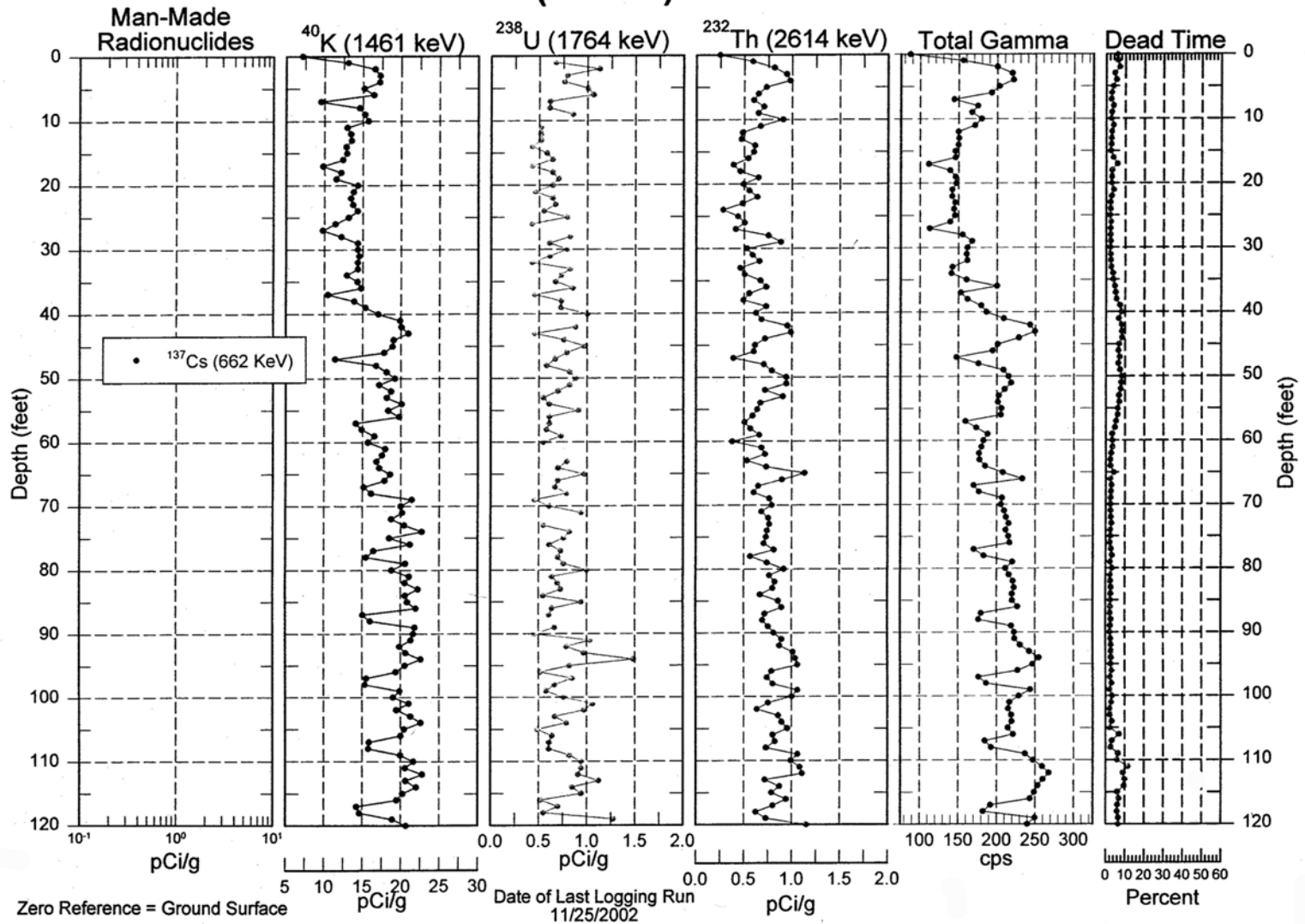
○ MDL

- 609 keV
- MDL (609 keV)
- 1764 keV

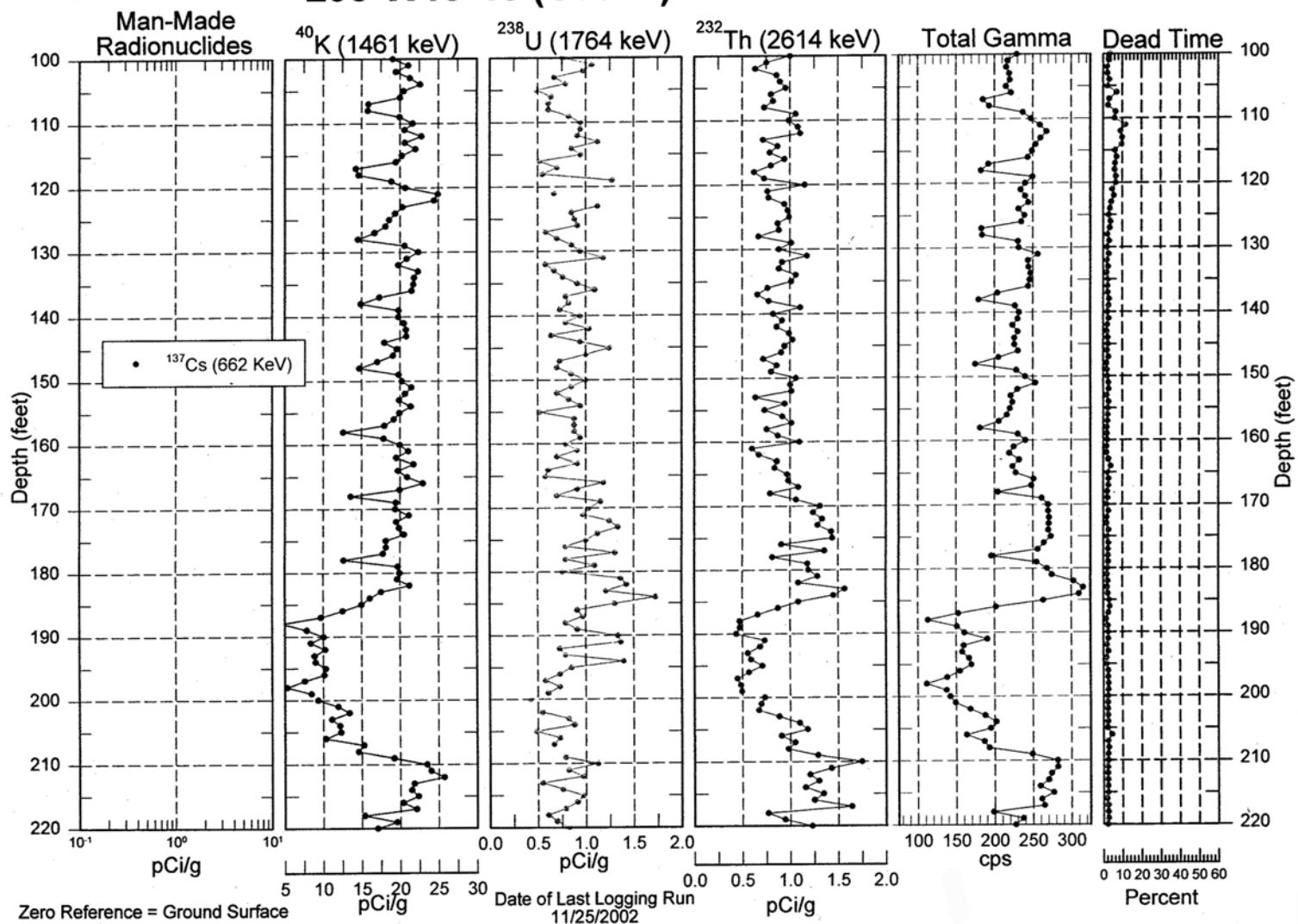
Date of Last Logging Run
11/25/2002

Zero Reference = Ground Surface

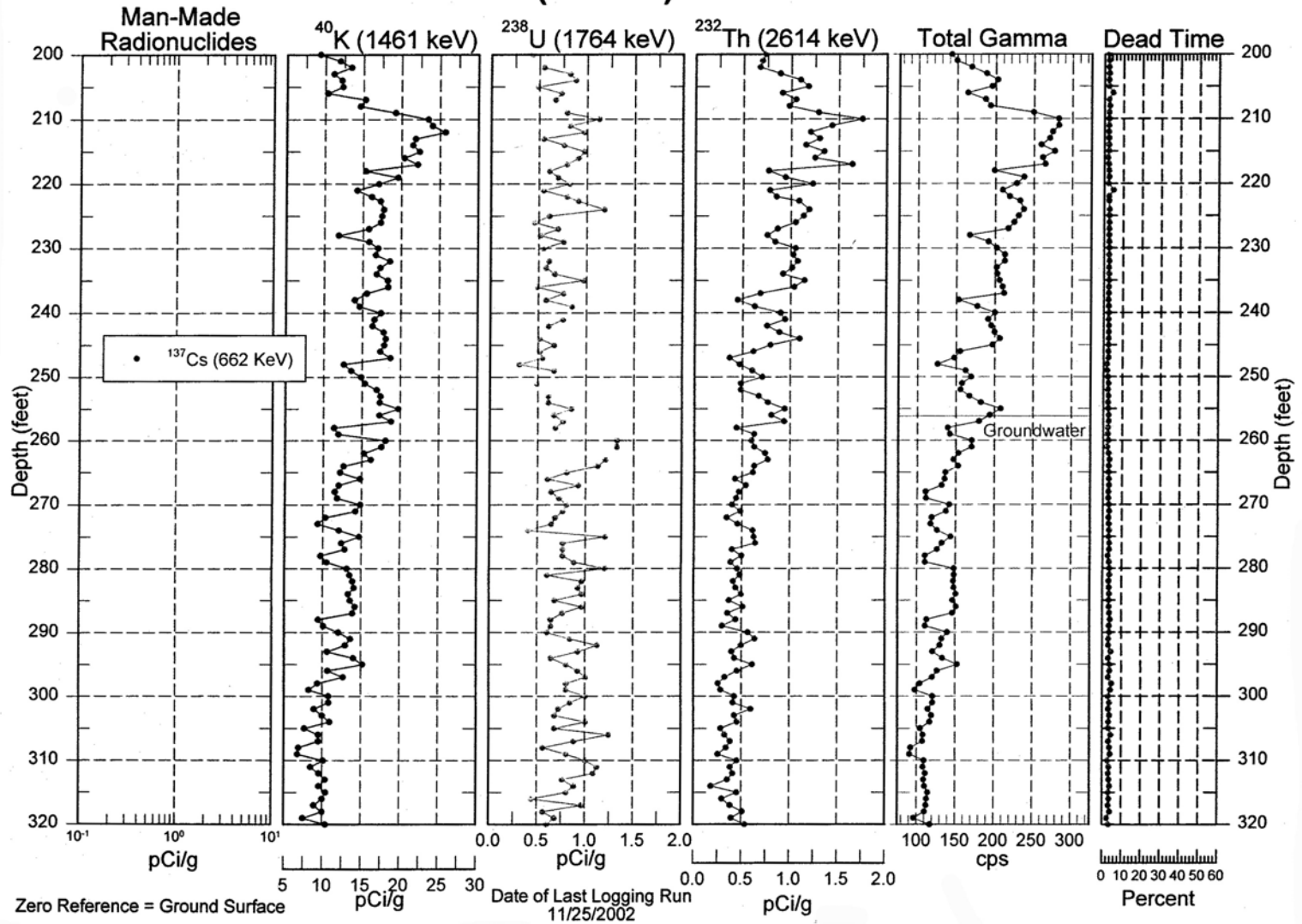
299-W19-46 (C3958) Combination Plot



299-W19-46 (C3958) Combination Plot

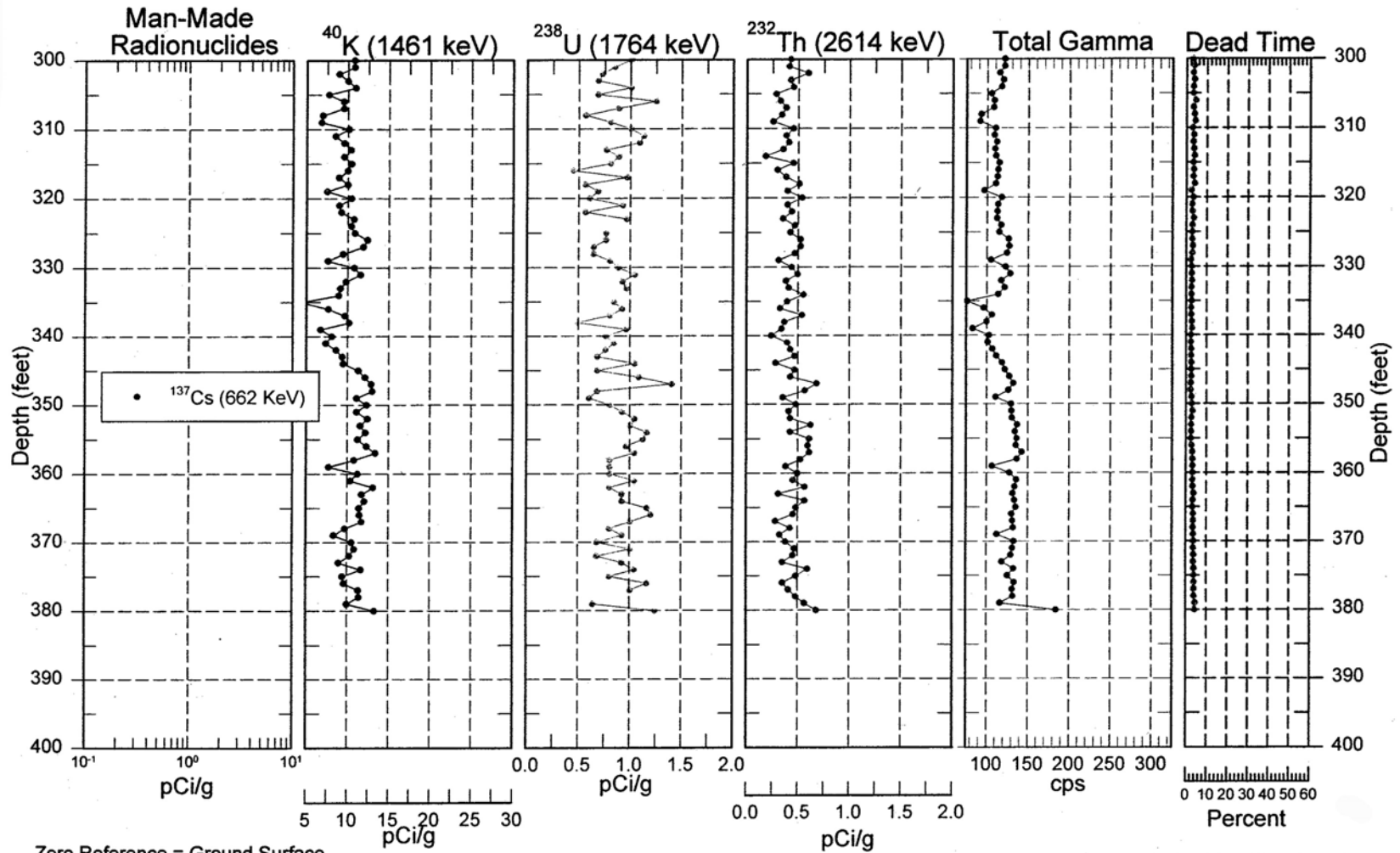


299-W19-46 (C3958) Combination Plot



299-W19-46 (C3958) Combination Plot

D.13

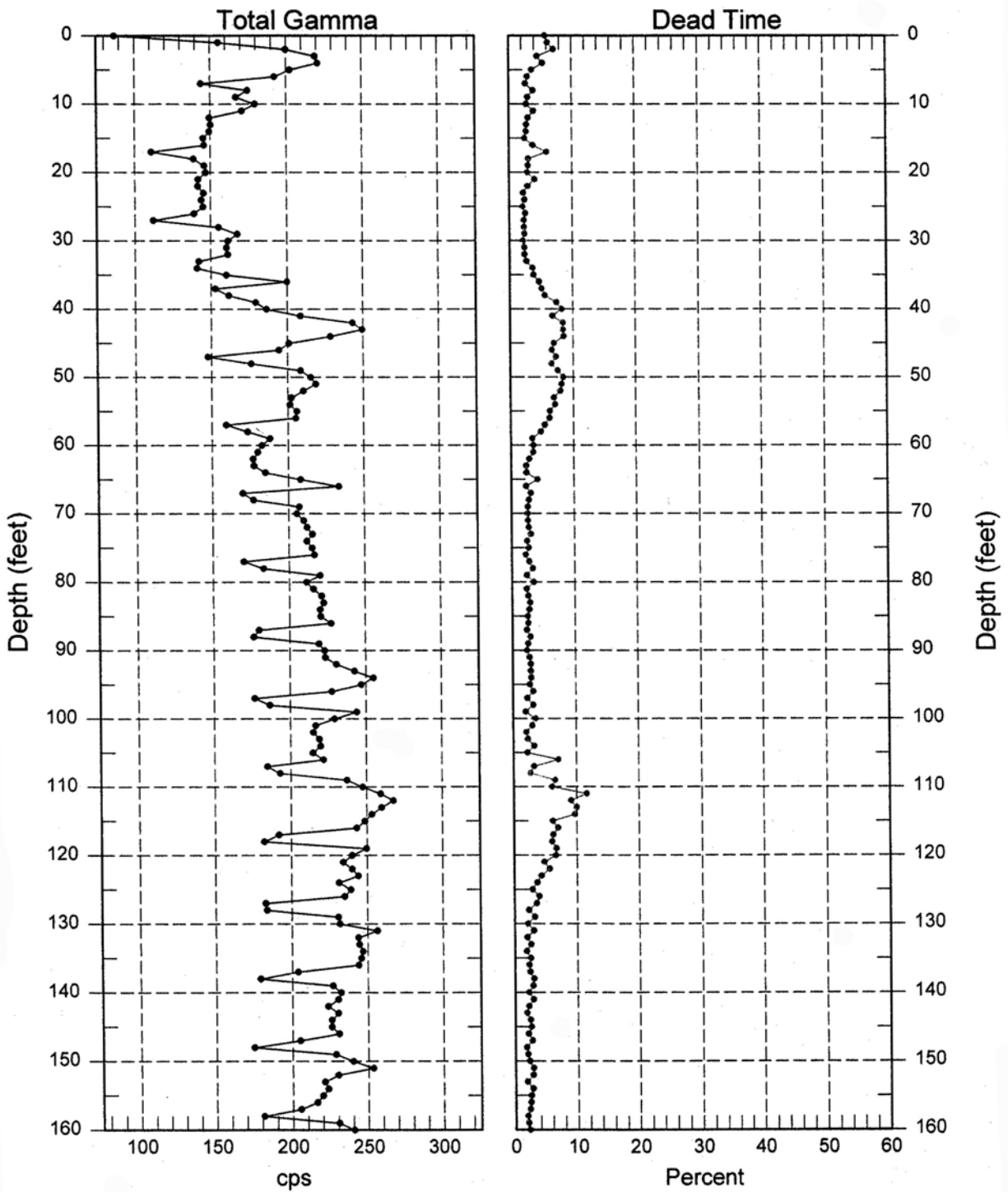


Zero Reference = Ground Surface

Date of Last Logging Run
11/25/2002

299-W19-46 (C3958)

Total Gamma & Dead Time

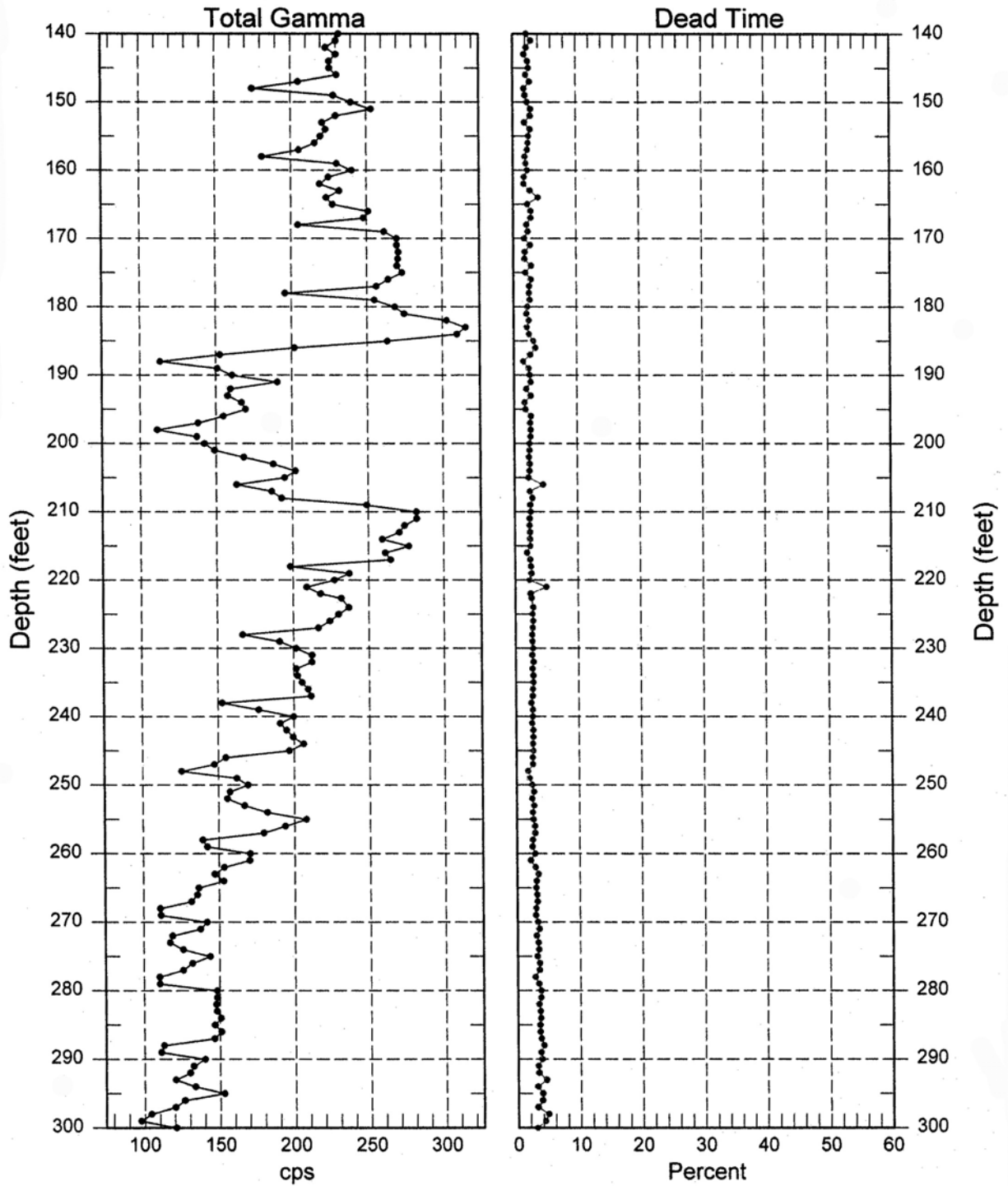


Zero Reference = Ground Surface

Date of Last Logging Run
11/25/2002

299-W19-46 (C3958)

Total Gamma & Dead Time

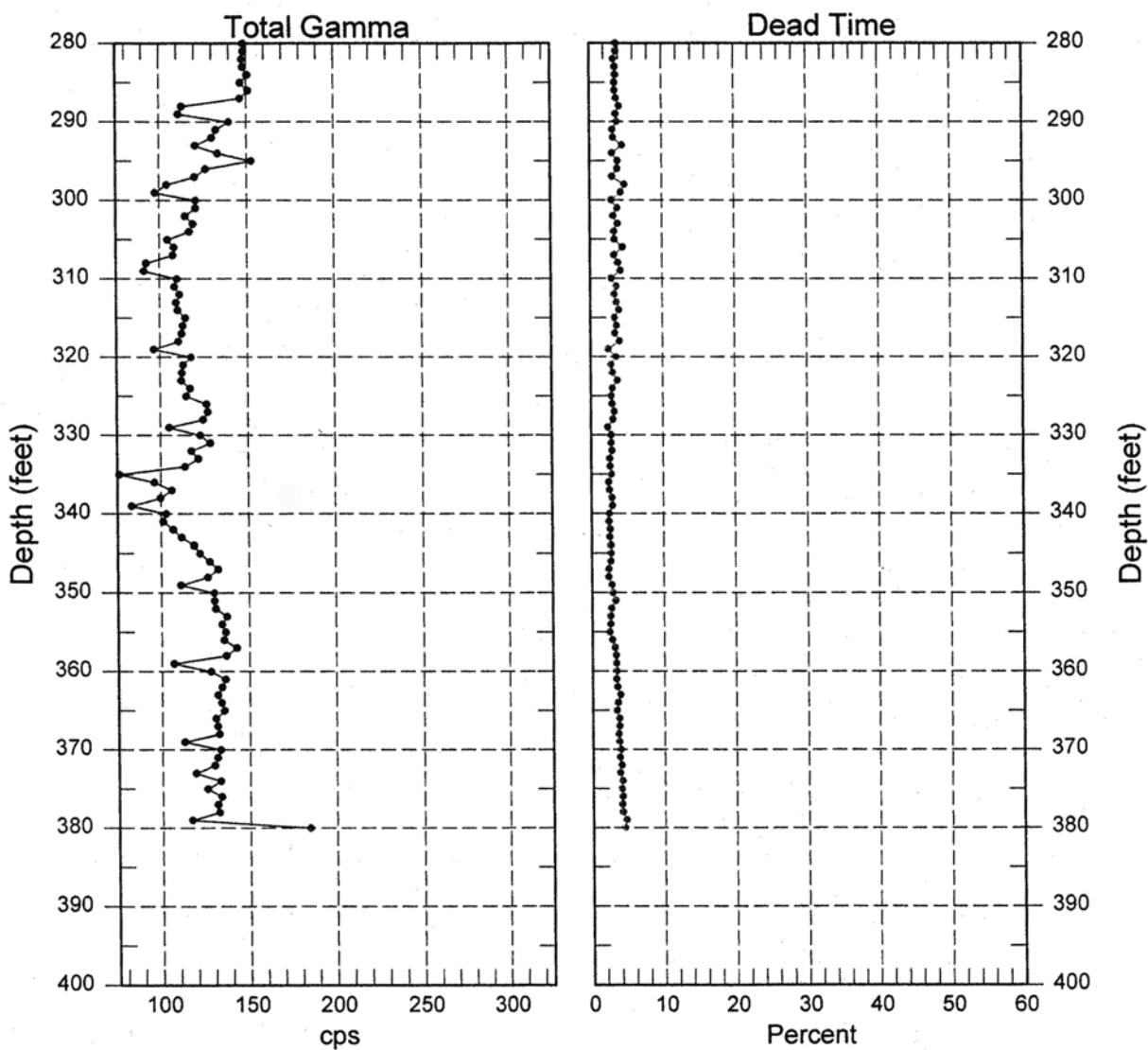


Zero Reference = Ground Surface

Date of Last Logging Run
11/25/2002

299-W19-46 (C3958)

Total Gamma & Dead Time

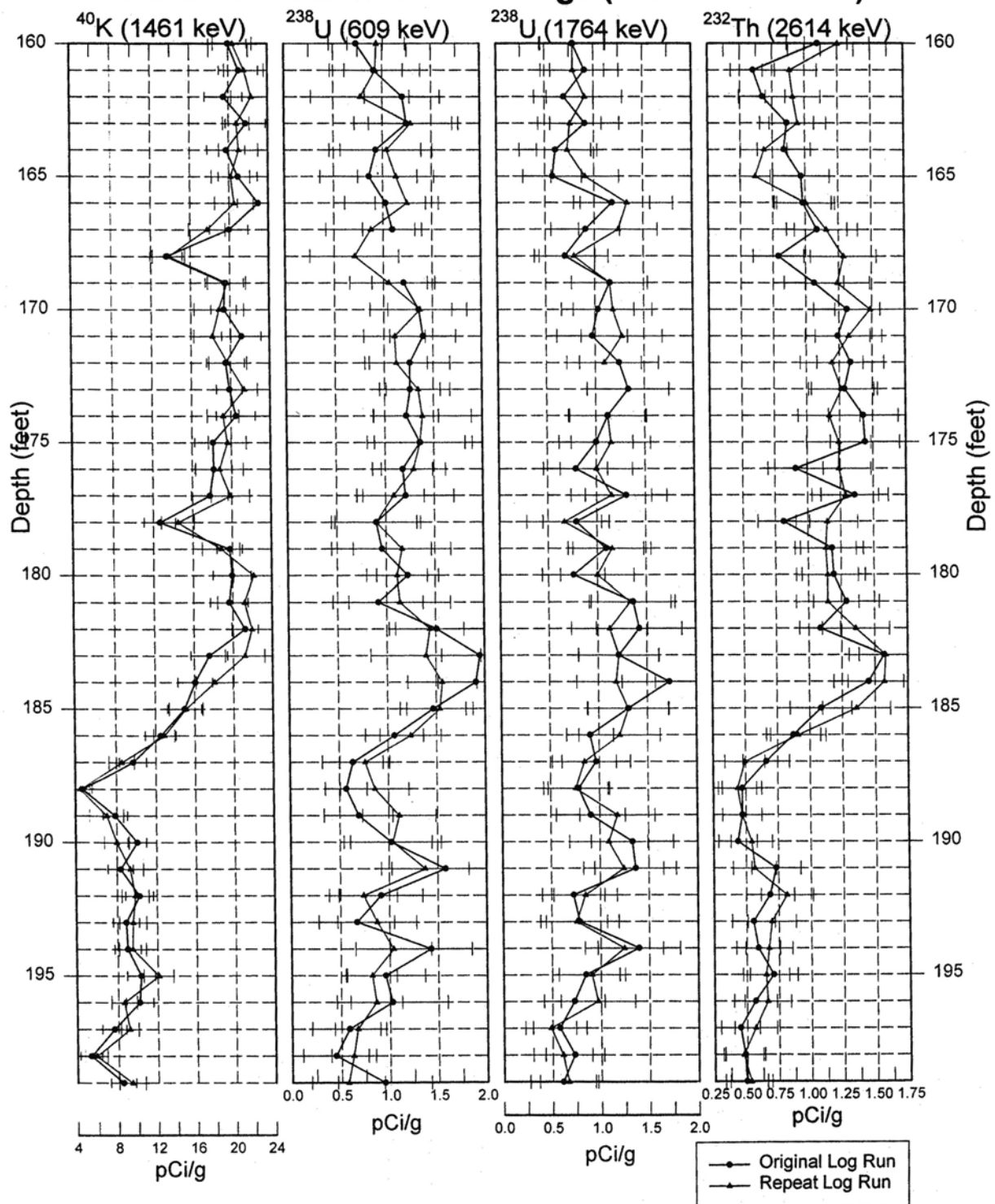


Zero Reference = Ground Surface

Date of Last Logging Run
11/25/2002

299-W19-46 (C3958)

Rerun of Natural Gamma Logs (160.0 to 199.0 ft)



Distribution

No. of Copies

OFFSITE

Confederated Tribes of the Umatilla Indian
Reservation
Environmental Planning/Rights Protection
P.O. Box 638
Pendleton, OR 97801
ATTN: T. Repasky

L. Seelatsee
Wanapum Band
Grant county P.U.D.
30 "C" Street S.W.
P.O. Box 878
Ephrata, WA 98823

P. Sobotta
Nez Perce Tribe
Environmental Restoration/Waste
Management
P.O. Box 365
Lapwai, ID 83540-0365

Confederated Tribes and Bands of the
Yakama Nation
Environmental Restoration/Waste
Management
2808 Main Street
Union Gap, WA 98903
ATTN: R. Jim

ONSITE

5 DOE-RL

M. J. Furman (2)	A6-36
A. C. Tortoso	A6-38
Public Reading Room (2)	H2-53

No. of Copies

3 Fluor Hanford, Inc.

J. V. Borghese	E6-36
R. L. Jackson	E6-35
C. Wright	E6-35

2 Washington State Department of Ecology

D. Goswami	B5-18
Z. Jackson	B5-18

U. S. Environmental Protection Agency

D. A. Faulk	B5-01
-------------	-------

11 Pacific Northwest National Laboratory

P. E. Dresel	K6-96
D. G. Horton (2)	K6-81
S. P. Luttrell	K6-96
W. J. Martin	K6-81
J. P. McDonald (2)	K6-96
F. A. Spane	K6-96
B. A. Williams	K6-81
Hanford Technical Library (2)	P8-55